American Machinist

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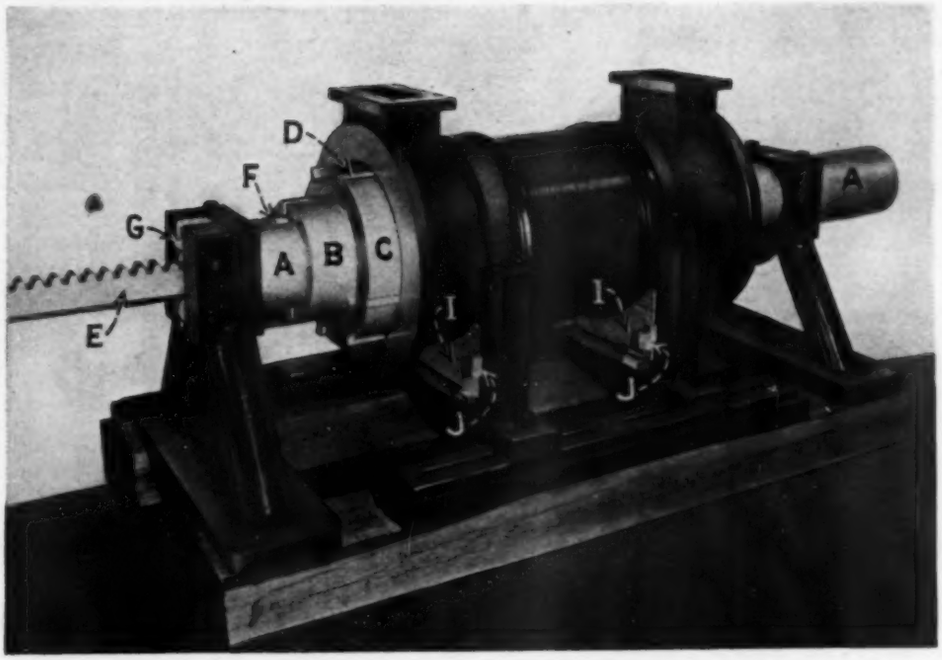


Fig. 1—Reproduction of Wilkinson Boring Mill

A TOOL THAT MADE HISTORY

JOSEPH W. ROE

Consulting Engineer, New York
Museum of Science and Industry

PROBABLY no machine tool ever built has justified the phrase "master tools of industry," the slogan of National Machine Tool Builders' Association, more than the boring mill built by John Wilkinson at Bersham, England, about 1775.

Watt invented the separate condenser, his first great contribution to the steam engine, in 1765. For ten years, under all sorts of discouragements, he struggled to build a successful engine. Smeaton, who examined and reported on his work, said, and correctly for the time when he wrote, that "neither the men nor the tools existed which could fabricate a mechanism so delicate."

Though Watt knew his engine was correct in principle, he could not make one which would work. His piston would either stick or leak so badly as to be inoperative, because he had no way of boring a full-sized cylinder either straight or round. Some which he tried to use were as much as $\frac{1}{8}$ of an inch out of round.

The best boring device available was a long slender shaft driven from one end and carrying a heavy cutter head at the far end where it was free to wander wherever the vageries of the cylinder core might lead it. E. A. Forward, in a paper before the Newcomen Society in London, says that such boring heads had been used on the cylinders for Newcomen engines and that, due to their weight and the lightness of the bars used, they cut mainly on the lower part of the cylinder, barely touching the upper side. To clean up the whole surface the cylinder was bored in four settings, 90 deg. apart, with but little improvement.

To realize what it meant to attempt to build large machinery without modern machine tools, the following

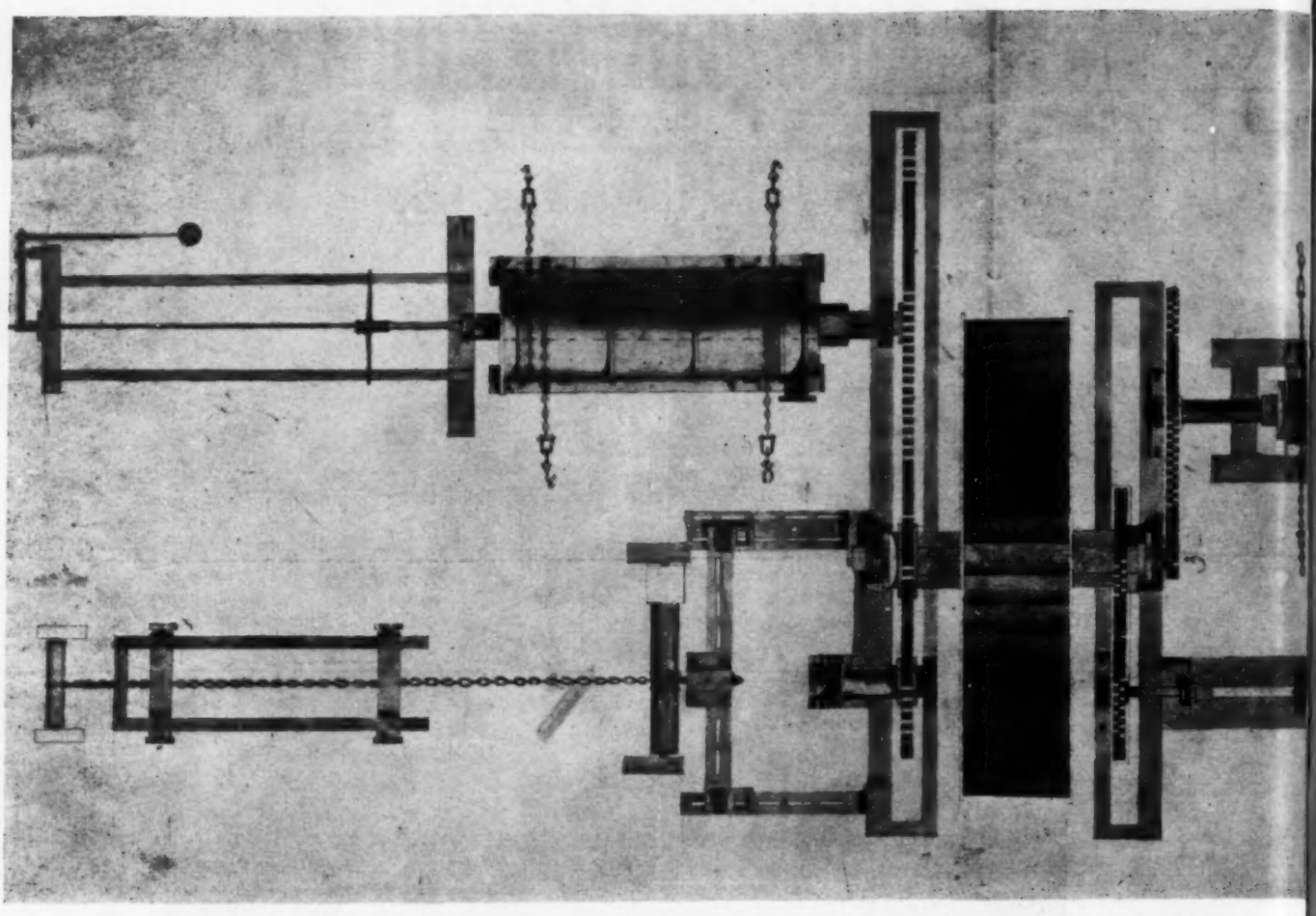


Fig. 2—"Drawing of the Bersham Boreing Mill by Jno. Gilpin"

quotation from the Journal of Franklin Institute, Vol. 25, 1853, is of interest. It is a report of progress on the boring of the cylinder for the first water-works engine in Philadelphia.

"The cylinder is 6½ ft. long and about 38½ in. in the bore; about ¾ in. was at first to be cut away. Two men are required (to bore); one almost lives in the cylinder with a hammer in hand to keep things in order and attend to the steelings (i.e., cutting tools); the other tends to the frame on which the cylinder rests, which is moved by suitable machinery. These hands are relieved. The work goes on day and night. One man is also employed to grind the steelings. The work stands at dinner and while the steelings are being changed, which requires about ten minutes' time, and in ten minutes they are dull. I examined some and found them worn ⅛ in. in that time. Three steelings, which are about 3½ in. on the edge, are fixed in the head piece at one time. The head piece is a little less than the diameter of the cylinder and 6 in. thick secured on a rod of iron 8 in. in diameter which forms the shaft of the waterwheel. The workmen state that the boring has been going on about three months and that six weeks more will be required to complete it."

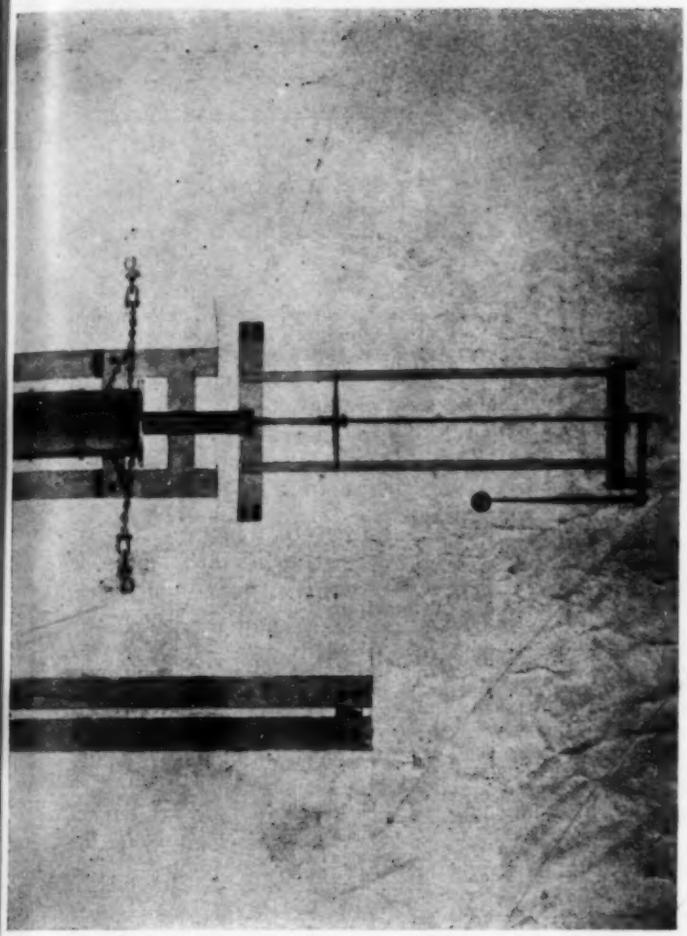
This cylinder, after all the labor, proved to be ⅜ of an inch larger in diameter in the middle than it was at the ends.

Finally Wilkinson made the steam-engine possible by building, at Bersham, a boring bar consisting of a large, stiff, cast-iron cylinder carrying a cutter head between two bearings. Watt wrote to Smeaton in 1776: "Mr. Wilkinson has improved the art of boring cylinders so that I promise upon a 72-in. cylinder being not farther from absolute truth than the thickness of a thin sixpence in the worst part." Boulton wrote to Watt the same year of another cylinder "true within the thickness of an old shilling," which seems to indicate the standard for accurate measurement then.

Until this boring machine was developed, Boulton and Watt had not been able to produce a single engine which worked satisfactorily. After that time they had no further trouble in making cylinders as true as the needs of that time required. The New York Museum of Science and Industry have made a reproduction in wood of a Wilkinson boring mill used for machining Watt's engines, which, if not the smaller one shown in Fig. 2, is the same design except for the method of holding the cylinder casting. This is shown in Fig. 1.

The original consisted of a heavy cast-iron boring bar, A, carried by two pedestals mounted on two oak stringers. Sliding on this bar is a sleeve, *B*, and boring head, *C*, with eight cutting tools, *D*. The bar is rotated by a gear, not shown, which was mounted at the far end beyond the rear bearing. The sliding cutter head was rotated by the boring-bar and its traverse was controlled by the toothed rack-bar, *E*, which reached into the hollow of the boring-bar and had a circular groove engaging a lug on the cutter head, which reached down through the slot, F. The rack bar itself was fed in by the pinion, *G*, which in turn was rotated by a ratchet lever carried on the square end of the pinion shaft.

In the original drawing, Fig. 2, the cylinder is held



by chains. In the machine reproduced, the cylinder rests on wooden saddles, *I*, and is held down by strap bolts after being centered by means of the wedges, *J*, shown. This method of holding the work seems to have soon come into use in place of the chains. The other of the two drawings in the Watt collection, dated June 8, 1795, shows a *vertical* mill of different and more elaborate construction, with a double gear reduction in the drive.

The drawing and description from which the replica is made were taken from an old encyclopedia, and may not show the precise boring mill in Fig. 2; but all the elements are the same except the method of holding and the details of the feed mechanism. It is believed, however, that the design of the reproduction is very close to that of the original mill at Bersham. This tool deserves high honor, as it was perhaps the first large machine tool with anything like modern precision and its influence. Through having made the steam engine commercially possible, its total value to mankind is incalculable.

The reproduction described may be seen in the collection of historic machine tools at the New York Museum of Science and Industry, 220 East 42nd Street, New York.

In 1919 two drawings were discovered among the early Watt drawings at Birmingham, copies of which are now in the Science Museum in London. The earlier of these is reproduced in Fig. 2. It has the title "Drawing of the Bersham Boreing Mill by Jno. Gilpin" and is undated. It shows a waterwheel mounted on an octagonal wooden shaft, and geared directly to this are two "boreing" mills, a large and a smaller one, and two lathes. One of the latter had a long bed and the other one, with a short one, was possibly used for facing cylinder heads. The general arrangement shows the sharp limitation imposed by the lack of power transmitting machinery, such as shafting, belting, etc., for all four machines are clustered around the waterwheel and geared directly to its shaft.

■

Accuracy Requirements of Multiple V-Belt Drives

R. E. S. Geare
Mechanical Engineer, L. H. Gilmer Company

VERY frequently in a multiple V-drive one or more belts will sag to a greater degree than adjacent ones. Conclusions are that these particular belts are stretching badly. While this may in rare cases be true, the facts are usually that the sagging belts are a small fraction of an inch longer than the other belts and were so at the time of installation, or that the V-grooves in the sheaves are incorrectly cut. Further, lodging of dirt on the sides of the grooves will produce unevenness in the belts.

Few engineers realize the large sag effect obtained by addition of a fraction of an inch to belt length. Where there are a number of belts transmitting the load it is desirable, but not of great importance from a standpoint of efficiency, to have all belts of an exact length. It is true, with a top belt sag, that with an increasing length of a belt and a resultant increased distance of sag, there will be a greater arc of contact on each sheave and hence a higher degree of power transmission. Considering the fact, however, that V-drives are figured for 180-deg. angle of contact as a rule, with an efficiency of transmission as high as 98 per cent, there cannot on a standard drive be any great advantage in increasing the sag purposely. The sag may appear to be quite great, yet it is not often considered how small may be the factor which creates it. For instance, take the question of difference in belt lengths. If the driving side is assumed without sag and a center distance between sheaves of 10 in. is assumed, a $\frac{1}{2}$-in. difference in length will give an approximate sag of 1.6 in., while a center distance between sheaves of 100 in. and a $\frac{1}{2}$-in. difference in length will produce a sag of 5 in. It becomes apparent that the actual distance of sag increases, for a given difference in length of belts, in proportion to the distances between centers.

Belt stretch is not always the main cause for unequal sags in belts. V-belts are now usually built in such a manner that appreciable stretch is impossible. The greatest trouble is usually found in the sheave itself. If all grooves are cut absolutely correct and are polished, seating action of the belt will take place simultaneously in each belt of the drive. If, however, the angle of one or both sides of the groove is incorrect, rust or foreign material may be deposited on one or both sides of the groove, or if the sides of the groove are roughly machined, certain belts will ride high in their grooves. Both conditions tend to increase the length of particular belts. Other belts will then have the appearance of sagging.

The Strong Case for

EDUCATIONAL ORDERS

SHOULD any citizen feel honest doubt as to the necessity for educational orders, let him read from the testimony of Frederick J. Haynes, war-time production manager of Dodge Brothers, Detroit, given before the House Committee on Military Affairs. Let its implications dig in.

"In October, 1917, we were approached to make a recuperator. We said, 'What is a recuperator?' We had no idea what it was. It was then explained to us that there are really three parts to a gun, the carriage, the recuperator and the barrel. The carriage carries the recuperator and on the recuperator is placed the gun barrel, and the object of the recuperator is to absorb the shock of the gun after the discharge and return it to its original position to fire, without having destroyed the aim or the range.

"After we got that explanation we said, 'Can we see a sample?' No, they had no samples. Then we were informed that it was complicated, that even the French were confident that were any of these recuperators to be captured by the Germans they could not be duplicated.

"The only thing we had to fall back on was the fact that we had been asked to produce them. Obviously, the country needed them and so we took a chance and said we would produce them, purely and absolutely with no knowledge whatsoever, excepting that if they had been made by man before, they ought to be able to be made by man now. That was the way we started to produce, gentlemen. That was all the information we had on which to start to produce one of the vital mechanisms of the war which was needed and for which our men were suffering because of their lack."

Through no fault of its own this company lost vital months; war was prolonged—lives obviously and needlessly sacrificed. Educational orders will prevent a duplication of this travesty. If authorized by the Congress at this time unemployment will be relieved as well. Could there be a stronger case for any project?

Write your Senators and Representatives immediately, while the thought is uppermost in your mind.

STILL MORE TYPICAL INDORSEMENTS

Seattle, Wash.

Relative to unemployment of skilled mechanics, I am assuredly in accord with your letter of November 24th, and the Hon. Frederick H. Payne's recommendations to Congress as outlined in the circular received, to amend Section 5a of the National Defense Act of June 4th, 1920. It will add a grand achievement to our country's preparedness.

JOHNSON MANUFACTURING CO.,
E. JOHNSON, President.

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Kenosha, Wis.

Answering yours of the 24th inst., I am very much in favor of legislation to authorize the Assistant Secretary of War to place so-called educational orders for munitions with private industry. We are already on the list of the Chicago Ordinance Department for this purpose, and have had several conferences with the Army representative, who is Mr. Russell's assistant.

I might say, however, that so far as we are personally concerned, while our business is depressed to an enormous extent, our tool and die department just at the moment is exceedingly busy in preparation for business which will come to us when times are better. This may or may not be a temporary condition, but the result, as you can readily see, is that our regular staff of toolmakers is fully employed, and for the present at least, a movement of this sort would not be of special interest to us. However, such legislation will take time, and conditions may be different by the time it is enacted and is put in force.

As a general proposition, however, we are heartily in accord, not only from the standpoint of relieving unemployment but as a measure of preparedness against future trouble.

FROST COMPANY,
W. J. FROST, President.

Racine, Wis.

I note your letter of November 25th in reference to legislation authorizing the placing of educational munition orders with private plants with a view toward keeping machinists, tool makers, and other skilled mechanics employed. Personally, I think this would be a very desirable procedure. It certainly would be educational along a line where we will surely need educating in another ten years as the men who got the brunt of the war work in the shops are fast disappearing. Some of the best mechanics in the country are in some of the smaller shops, shops similar to our own, for instance, of which there are a great many, and we cannot see how this work could be distributed among the smaller shops. Some of them could not afford to take it on as it certainly would not mean much but trouble and expense if it were properly placed. However, educating 50 per cent of our mechanics would be better than none at all. I trust the matter will go through as proposed.

GEORGE GORTON MACHINE CO.,
GEO. GORTON, President.

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Detroit, Mich.

The editorial in the November 20 issue of the *American Machinist* with respect to Educational Orders for unemployment relief, and supported so ably by Assistant Secretary Frederick H. Payne's article on "The Educational Order" seems to us to represent a very practical suggestion at this particular time.

One who understands the purpose of the legislation with respect to the Educational Order can appreciate that the experience thus afforded the industry in the production of munitions in time of peace will repay us all a thousand-fold should the emergency arise. Meanwhile, it affords opportunities for the procurement of materials of war by the government at certainly no greater cost, and possibly at less, than by its production in government owned plants.

We believe that industry as a whole will heartily indorse the proposition and we congratulate you upon the stand taken by the *American Machinist*.

CONTINENTAL MOTORS CORPORATION,
L. J. KANITZ, General Sales Manager.

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Frankfort, Ind.

Your letter of November 24th is, indeed, a timely letter. How well the writer remembers how unprepared we were to make materials for carrying on a war, as this company unfortunately undertook to manufacture an adapter for high explosive shells. In submitting a bid to secure the contract we certainly poked our head into a bag, and even worse yet, it was discovered that when the specifications came through, the bid we submitted would not pay for the master gages, let alone the working gages and the rest of the tools and the labor. The truth of the matter is that the master gages could not even be built so as to pass the Bureau of Specification and Inspection, as there was no equipment made in this country at that time that was built accurately enough to make this equipment. We might mention that if it had not been for the stress of urgent need, that we would never have been able to furnish a solitary piece, and it is just a question whether, at the present time, anything could be made in the average plant that would really pass government inspection.

From this you will understand that in the writer's opinion, if there is a bill passed by Congress under the head of Educational Orders for the education of mechanics to make munitions of war, they should be paid for all the material that is used, or in other words, all the time spent to teach them how to make this material.

We might mention that if there should be another war, this company would not seek any contract from the government to make war material. We would, of course, turn the plant over to the government and offer them our services. Of course, very little, if anything, would be accomplished, as you can readily understand.

THE INDIANA BRASS COMPANY,
JOHN A. JOHNSON, President.

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Cleveland, Ohio

Answering yours of November 24th, we think that the reason advanced—that educational munitions orders will tend to relieve existing unemployment conditions—is, or should be sufficient argument for placing such orders at this time.

A more important reason, considered from the standpoint of national defense, is that such education would place certain factories in a position to understand the problems of the work assigned to them, so that in the event of a national emergency these problems and their solutions would be a matter of record. The saving in time would be worth all the expense, and should strongly appeal to any one aware of the delays occurring in the World War program due to conditions occasioned by lack of just this kind of preparedness. We hope such an emergency will not occur again, but, as has been frequently said, the best and surest way to prevent its reoccurrence is to be prepared for it.

THE AMERICAN MULTIGRAPH COMPANY,
R. G. A. PHILLIPP, 1st Vice-President.

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Cincinnati, Ohio

Replying to your favor of November 24th and referring to your editorial with above title, would state that it would be well, of course, if Congress should pass a bill enabling the government to place such orders with the proper machine shops throughout the country but not only as a method of unemployment relief. There is no question but what it would give work to quite a number of persons; but it would certainly give manufacturers a necessary experience, contemplating the possibility of their use in the future. In other words, it is a thoroughly sane and sensible thing to do from several points of view.

In our shops we normally employ about 800 people—we are now employing about 500—and an experience in the manufacture of necessary goods for the Government would certainly be helpful to all concerned.

THE AMERICAN TOOL WORKS CO.,
J. B. DOAN, Pres't & Gen'l Manager.

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Cincinnati, Ohio

In reply to your letter of November 25th with which you had attached reprint under heading "Educational Orders as Unemployment Relief." Unquestionably, this would be a very good time to have educational munitions orders placed in private plants as it would, no doubt, give work to a great many mechanics now out of employment and would be an ideal time to do the necessary experimental work connected with this undertaking.

THE ACME MACHINE TOOL CO.,
CHARLES MEIER, Treas. & Gen. Mgr.

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Waterbury, Conn.

We received Mr. Condit's letter of November 24th. We are quite in sympathy with having Congress make an appropriation for educational orders along the lines outlined by Secretary Payne in his article in the *American Machinist* of November 20, 1930.

THE WATERBURY FARREL FOUNDRY & MACHINE CO.

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New Haven, Conn.

Your letter of the 24th strikes a very responsive chord with us. Of course, we in industry have a real immediate problem which we must recognize and face, and that is, taking care of our people so that they are clothed, warm, and well fed, and given every possible opportunity to work enough to keep them out of the terrible depression that comes with inactivity and that helpless inability to provide for their barest needs.

We feel that there are really only two ways to meet this condition—one is, to recognize that it is an actual condition that no artificial false stimulation can cure; and take the two elements which are actual and real, that is, that there is so much business here with us today and so many people, and so apportion those two elements that everybody will be reasonably absorbed and reasonably taken care of. Second, which is directly in line with the specific suggestions that you make, that is, releasing all work which can possibly be done consistent with sound aggressive business policies, such as, Federal, Governmental, State, and Municipal work which is needed; industrial work which must be done, and such work as you suggest, where you may be sure that we are in hearty accord and subscribe fully to your proposal. If there is anything that we can do to help crystallize and foster a plan for the consummation of your suggestion, please do not hesitate to call upon us.

SARGENT & COMPANY,
R. B. GERARD, Vice-Pres. & Gen. Mgr.

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Boston, Mass.

I am greatly in favor of government helping industry over its slow periods. Conversely government should not be stimulated during periods of industrial activity to abnormal buying as seemed to be the case in 1929.

Our corporation manufactures a class of product which could well be considered appropriate in the program suggested. Not only might we do special work, but we could be much benefited by orders to overhaul precision lathes of our manufacture which have long been in government service and require repairs as well as to furnish at this time new lathes and attachments for departments which have requested them, or at least requested appropriations for such new machines. There should be available in Navy Department supplies quite a number of Rivett back geared precision lathes removed from old battleships and cruisers which would be well worth reclaiming. There must also be required for new vessels a number of new lathes and the release of orders for these machines would greatly alleviate our depressed condition.

By all means add our name, if not too late, to your roster of manufacturers approving the movement.

RIVETT LATHE AND GRINDER CORPORATION,
THORVALD S. ROSS, General Manager.

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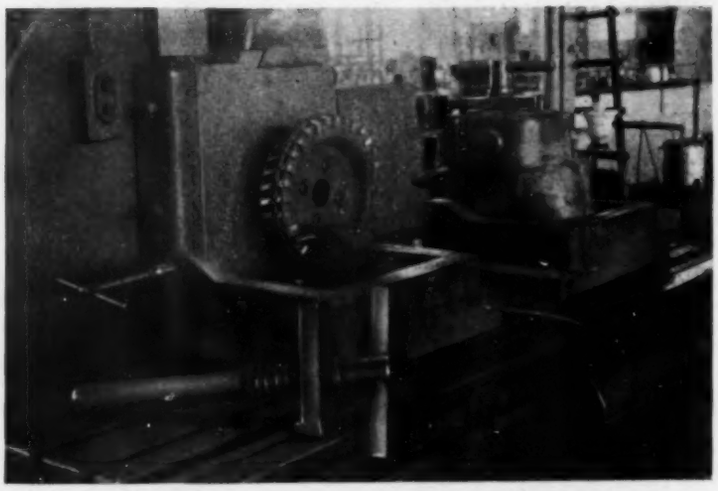
Hudson, Mass.

Referring to your letter of November 25th, we would say that we think your plan of having work given out by the government for educational purposes on war munitions is a good one.

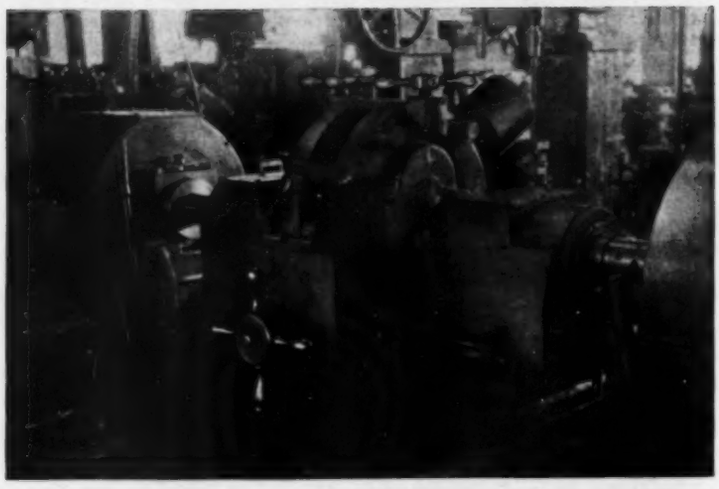
Our Works Manager, Mr. J. C. Spence, was well acquainted with several German manufacturers before the war, and he knew that the government had been giving them educational orders so that when the war broke out they were ready immediately to supply munitions.

We should be glad to see such a movement as you suggest carried out successfully.

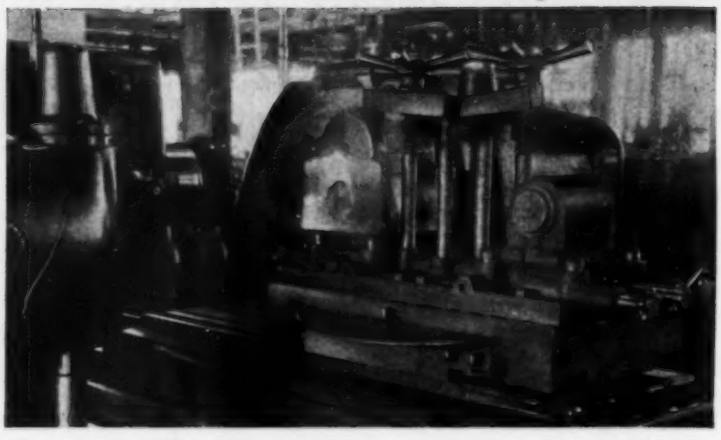
UNIVERSAL BORING MACHINE COMPANY,
C. A. CLARKE, President.



Simple twin fixtures hold the case for the first machining operation, locating it on hardened pins. Variable feed during cutting is attained by dogging, and production is 42 pieces per hour



Boring of main bores, from which all future locating is done, is handled in a twin-head boring machine with center fixture, the work being set upside down on hardened pins and clamped sidewise by two pairs of equalizing pins advanced simultaneously by a front handwheel. The counterbalanced top swing clamp is held in front by a latch, twin capstan wheels above clamping vertically. The same operator does finish line reaming in a single-spindle drillpress



A capstan wheel moves locating studs into the finished main bore holes preceding duplex milling of the main bearing surfaces. Squaring of the case is by four pins in independent pairs bearing against finished cover-plate surfaces, and the clamp bars and capstan wheels supply additional vertical pressure. Production, 44 pieces per hour. Countershaft and reverse idler holes and bosses are similarly set up for machinery

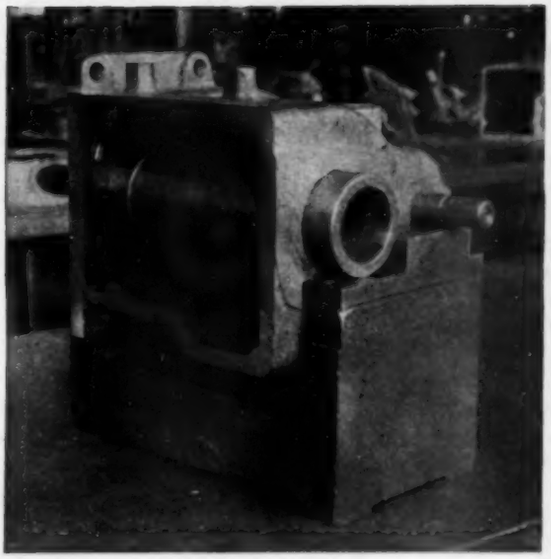
SET-UPS PREPLANNED FOR FLEXIBILITY

FLEXIBILITY, a prerequisite in the lining up of equipment for economical production of varied automotive parts, is usually attained at the expense of production time. Here are shown a series of close-ups of the machining of a transmission case at the Clark Equipment Company, Berrien Springs, Mich., wherein standard machines, with simple fixtures, are adapted to economical production without sacrifice of flexibility. Originality has been displayed in both the fixtures and the tools illustrated.

Remaining small holes are drilled and tapped in this battery of twelve single-spindle drills with multiple-spindle heads. Simplicity of fixtures is evident. Two operators tend the entire line, moving the cases by hand between machines

Facing of inside bosses on main bearings is done with a special internal milling attachment. Production time is 1 min. per piece. A special fixture embodying a lever and self-locking toggle holds the work. Outside facing is completed on an engine lathe, the work being swung on an arbor engaging the main bore

The special tool for cutting oil retainer grooves in main bearing bores. The tool comprises two independent elements sliding on a spindle against spring pressure and corresponding cones that cam the tools outward. These do the cutting through pressure from the tool bodies after they are seated, the lower toolholder seating in a cup in the baseplate, the upper through a collar that contacts the finished end of the casting



Inspection device for measuring out-of-parallelism of the countershaft within the main bore. Misalignment is detected by a rocking motion of the four points of the supporting fixture; hole sizes are tested with "feelers"

EXECUTIVE FORUM

Convenience or Confusion?

"I'VE JUST been reading an article by Dr. Guillaume on the metric system," said Arthur Spalding, Chief Engineer of the Masfield Foundry and Machine Company. "Some of his arguments in favor of it are convincing."

"More propaganda," commented Thomas McMurray, Works Manager. "I hope you didn't let him sell you the idea."

"Not entirely," said Spalding, "but I can see its advantages. Our present system of weights and measures just grew like Topsy. The metric system has the merit of a scientific basis. This country's monetary system was planned on a decimal basis, and now we wouldn't consider any other. Its convenience is obvious."

"Did you ever stop to think that we actually use a decimal system in the machine shop," McMurray asked? "We use inches and thousandths of an inch for all accurate work."

"But we have no simple relation between linear measure, volume, and weight," said Spalding. "A cubic decimeter is one liter, and one liter of water weighs one kilogram. That's certainly convenient enough."

"Theoretically yes," said McMurray, "but not of great importance to the man in the shop. He can mike a shaft in thousandths of an inch and buy his milk by the quart without worrying about the relation between them."

"More countries use the metric system than any other," said Spalding. "With increasing international trade, there should be a universal system, and it would be logical to adopt the one most widely accepted. Only the United States and Canada retain the English system on this continent. We could probably increase our export business if we made machinery to metric standards."

"When making comparisons," said McMurray, "don't overlook the commercial importance of countries. Sixty-two per cent of the exports and imports of the Western Hemisphere are made to English measurements. If the majority is to rule, trade volume must be considered. No one has ever proved that changing to the metric system would increase exports."

"We already use the metric system in electrical, medical, and other scientific measurements," said Spalding. "Congress is constantly petitioned to make the metric system our legal standard."

"The vociferous minority again," said McMurray. "In this country, anyone can use any system he chooses as long as seller and buyer agree upon the same unit. A small group which tries to impress its ideas on everyone always causes trouble."

"The added convenience of the metric units should materially decrease manufacturing costs," said Spalding. "Some defenders of the English system claim that its increased complexity gives employment to more people. That's as futile as going back to hand labor to relieve unemployment."

"I don't admit that the decimeter is as convenient as the inch for shop work," said McMurray, "and I don't know of any metric country that has equalled our manufacturing costs. But since you're interested in articles on the subject, I'd suggest you read Luther D. Burlingame's reply to Dr. Guillaume. The big objection to the metric system is the confusion and cost of changing to it."

"The longer we postpone the change, the more it will cost eventually," said Spalding.

"If we put it off long enough" said McMurray, "it won't cost anything."

■

What Do You Think About This Problem?

Numerous attempts have been made to convert this country to a metric standard. Theoretically the use of metric measurements presents many advantages. Would these advantages be reflected in increased facility in manufacture were the system adopted? If such advantages are of practical importance, would they offset the cost and confusion involved in making the change? *American Machinist* invites your views on this subject.

. . . Discussion

of Executive Problems

■

On With the New?

By all means advance the old employee, if in your estimation he is progressive and not hidebound, for his years of service are his investment on which he hopes to realize the dividends of higher salary and the distinction of promotion. New blood is necessary for a concern occasionally, and if the management does not introduce it, the stockholders probably will. Careful and candid judgment is necessary in choosing men, and often the mistake is made of assuming that any man will do, or that a nice fellow met on the golf links, in these days of democratic golf, is worthy of a chance.

Thorough investigation of a man's record of past performance, and your best judgment of his personality, will pick the best man, but whoever you choose, back him all you can. If he has the company behind him, he can command respect and offset the jealousy of a newcomer by those who aspired to the position.

—JOHN S. ISDALE, *Plant Engineer, International Silver Company.*

Is Interest Important?

To include interest on investment in overhead expense is undoubtedly the more exact way of costing. The profit due to manufacturing operations will be reduced accordingly, but the shareholders' dividend will remain unaltered. Earnings clearly result from two activities: one part is from the money invested, and the other from the manufacturing activities made possible by this investment.

With the interest on investment figures available together with other cost figures, many weak points in the equipment policy become apparent and may be rectified. Similarly purchasing and selling policies and their effect on investment cost can be studied. —S. A. KNIGHT, *Irak Petroleum Company, Tuz Khurmati, Irak.*

How Much Incentive?

The value of a bonus system will depend on two factors: correct rate setting and no tampering with rates once they are set. If the work or job is altered so as to affect the time required, then the rate must be reset. The proper percentage to be allowed the workman is governed by how much it will cost to operate the bonus system and how much the company will allow its workman to earn. The following example shows the best means of arriving at a decision:

Time allowed, one hour; rate, 75 cents per hour; time taken 0.75 hr.; time saved 0.25 hr.

Under the 100 per cent plan the workman would receive as follows:

Minimum rate	0.75 × 0.75 hr. =	0.56
Bonus	0.75 × 0.25 hr. =	0.19
Total for 0.75 hr. work		0.75

The profit to the man is 19 cents and that to the company is a 25 per cent reduction in overhead, minus the cost of installation and upkeep of the bonus system.

Under the 50-50 plan, the workman receives a bonus of 9½ cents. The profit to the company is 9½ cents plus 25 per cent saving in overhead, minus the cost of the bonus system. Under the 30 per cent plan the workman receives 6.7 cents bonus. The profit to the company is 12.3 cents plus 25 per cent saving in overhead minus the cost of organizing and operating the system as previously mentioned.

From the foregoing it should be evident which proportion to choose. The one most used is the 50-50 plan, which, I have found, provides a reasonable incentive for the workman and sufficient margin for the company.

—H. F. FIEDLER, *Foreman, New Era Manufacturing Company.*

Too Much Specialization?

Functional organization to the extreme has its faults —no one denies that—but it is the only possible way of running a big concern. Recently I took a responsible position with a large company. Their product is good and their output large. Yet it was months before I could collect the strings of production, before I could insure getting memoranda from men theoretically under my charge. And the only reason for this was that each department was running as a special little factory. They ran well too but with utter disregard for each other and thus for the firm as a whole.

Regarding the condition presented—how was it that the shops managed to get into such a state that all the press hands had to turn out on a job of cleaning? Any foreman should keep his machine beds clean whether he has men for that purpose or not. I have yet to find a works with a foreman who can't do it if he wants to.

—B. BROWN, *London, England.*

The More the Brainier?

Some years ago, the writer was on the staff of a firm, the head of which was an inveterate inventor of machinery. He consulted every department head at various times, and when a successful result was obtained, the chiefs of every department, from drawing office to foremen were called together, and every point in manufacture discussed. The "Old Man" went into the question of new machine tools if required. Everyone had a say, after which he was expected to forever hold his peace. This method, the "Old Man" declared, prevented spend-

ing a dollar in one department to save ten cents in another, and proved very successful.

On another occasion the writer, with others, was discussing a jig problem that was giving considerable trouble. A young draftsman arrived on the scene with a message regarding another matter. Handing this over, he casually remarked, "Over at Blanks they did that job the other side up." A simple remark that solved our problem. By bringing all the available brains together, someone is pretty sure to throw out a random remark that may be simple but effective in ironing out the difficulties. —F. P. TERRY, *Belfast, Ireland.*

Speculating in Personnel

His personnel is probably one of the greatest assets of a manufacturer, but there are very few who realize this truth; a good man leaving the organization is not only a loss, but may become a live asset to a competitor. He will probably take with him not only his knowledge and experience, but any outstanding layout or time saver that gave his late employer an advantage.

Wholesale discharge has also a bad moral effect. Men cease to be wholehearted in their jobs, and even if they are not themselves discharged, they begin to look around for another shop. A number of the large manufacturers get over this difficulty in the following way: The senior key men are staff, but the foremen are paid by the hour, they are also paid overtime and receive a production bonus. In the event of quiet times, if short shift has to be worked they also go on a short shift, and if they work half a week they receive half pay, so that overhead goes down as production goes down. —A. A. GIGLI, *Birmingham, England.*

Sales Per Schedule

One November the sales manager, the president, and I took the catalog and laid out the next year's probable business item by item with approximate sales quotas for each quarter. These were determined partly from past sales and partly from probable business forecasts for the coming year. From this, the manufacturing and purchasing schedule of raw materials was built up on a quarterly basis. The advantage of this scheme was that it actually worked, and when sales department found a quarterly inventory building up on any item, it reduced or stopped its orders to the manufacturing department for the following quarter. We secured a balanced inventory and called immediate attention to items which should be selling better. At the same time the sales manager sent his men to old customers or new prospects with instructions to sell these slow-moving items.

Selling time was put in on a definite list worked out by the sales manager and the salesman concerned. There were certain customers the salesman visited once or twice a month. When his list of worthwhile prospects became reduced, additional prospects were added. Thus we secured concentrated sales effort where it could secure the maximum volume of orders. Our selling costs dropped almost twenty per cent, and sales volume increased during a slight business recession.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Company.*

Research or Retrenchment?

Thanks to idealistic and philanthropic men and women of days gone by, science has been able to show the way to the high standard of living that we now enjoy. Should this spirit of sacrifice for the common good disappear, we are surely going toward dark ages in the near future. It is not sufficient for a company to keep in touch with current scientific developments. Every manufacture has some special problems that require research beyond that to meet his individual needs.

Common sense is the only means of measuring the amount of research necessary. One must look to the individual effort for development in any particular line. There is such a thing as competition in development work which would suffer if greater co-operation were the aim. I realize, however, that much overlapping work could be avoided by greater co-operation, but how should the profit derived from such effort be divided?

—A. E. FRISTEDT, *Bolinder Works, Stockholm, Sweden.*

Home Work

Homework is the safety valve by which good men meet emergencies; cultivated as a habit it merely acts as a brake on the personal machine that locks itself into position and retards its normal rate of speed.

A chronic homeworker is in my opinion not an energetic man—on the contrary, I believe he is a lazy man. He confesses he is unable to accomplish his work in the time assigned to it. In addition, he is confining his normal range of activity to such a narrow line of action that he is not a good prospect for promotion because he has entirely lost the broadening influence of outside activities, which are so essential to the major executive.

I admit of only one worth-while exception—the young man new in industry or not yet equipped with the basic knowledge of his particular industry. If his brief case contains information to be absorbed as part of his education, and which is entirely apart from his task of the day, he's on the right track.

—CHARLES KLYNE, *Foreman, Russell Machine Company.*

The Fewer the Higher

The odd lot, or the rush replacement job, breaking in as it does on production schedules, is seldom profitable to any concern. Departmental overhead instead of a flat rate should be used in calculations, and the charges so obtained will not be excessive when one takes into consideration the break in production occasioned. Even when the job is completed, there is considerable adjusting before production gets back to normal. This often runs away with the few dollars profit, if a too close an estimate was made.

It is often good business to explain this to the customer when submitting your price estimate. He will readily see why the job is costing more than formerly. Service is often more important than the extra cost involved. —ROBERT S. ALEXANDER, *Universal Winding Company.*

TAPS AND TAPPING

R. E. Beimer
Assistant Superintendent of Tap Department,
Charles H. Besly & Company

NO FUNDAMENTAL changes in tap design have been made recently, but refinement in constructional detail, in accordance with results of experiment or the experience gained through years of shop practice, has made the present-day product far superior to that of a decade ago. Closer manufacturing tolerances and more careful inspection have resulted in more uniform sizing; a more complete insight into steel and its heat-treatment has improved cutting and wearing qualities; and the development of certain constructional principles has enabled some manufacturers to place on the market a product capable of threading holes with increased ease and accuracy. Not that tap construction has been perfected. There is still a vast field of exact knowledge essential to correct design which must await future experiment and discovery. The numerous variables met in any tapping problem prevent the average tap from doing perfect work at all times. This statement is not made to excuse tap failures but merely to set forth a fact which all tap users would do well to recognize. In time of failure, many workmen are prone to place all the blame on the tool without making a thorough analysis of the problem.

Taps, like all tools, have their limitations. It is usually difficult to determine the exact limit of a given tap. The owner of a 1-ton truck would blame only himself if the truck broke down when loaded excessively, or when loaded with a reasonable weight, was driven at an excessive speed over a rough road. In this instance, the driver would know the reason for the mechanical failure of the vehicle. But in tapping, most of the factors bearing directly on the life of the tool as well as the size of the tapped hole are far less apparent. The following list serves to emphasize the general factors that influence tap life and to illustrate the complexity of the research problem affecting this subject:

1. Kind of material tapped
2. Condition of material tapped
3. Size of drilled or punched hole
4. Depth of hole or thickness of piece
5. Pitch and form of thread desired
6. Cutting fluid used
7. Speed at which the tap is operated
8. Type and design of machine in which the tap is used
9. Design and construction of the tap
10. Condition of the tap

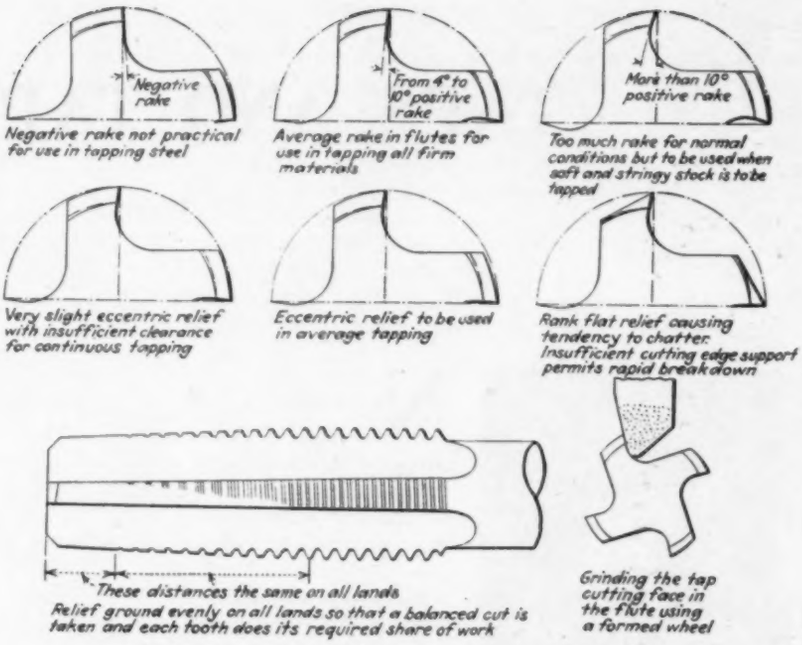
The material to be tapped is normally beyond the control of the tap user. When an unfamiliar material is to be tapped, it is essential that the tap manufacturer be advised so a tool may be furnished which, in his experience, will yield the desired results. Hardness, machinability, and other material characteristics may or may not be controlled by the tap user, but they are important considerations in tool design. The tapping speed and cutting agent should be selected to meet the conditions of each job. Tap design, particularly the angle of hook or rake in the flutes, should be altered to give the best results for the material to be machined. In ordering taps for materials exceptionally difficult to work, it is advisable to submit samples of these materials to the tap manufacturer.

The size of drilled or punched holes is controllable, but the relation between this factor and tap failure is frequently overlooked. Hole sizing is usually a matter of manufacturing policy or specification. Although the difference between a 75 per cent and a 90 per cent thread in a ½-in. nut (U.S.S. 13 threads) is but 0.0075 in. in the height of the thread (0.015 in. in the hole diameter), tests made several years ago showed that even under favorable conditions, the power required to tap the 90 per cent thread in a cold punched nut is almost double that required to tap the 75 per cent thread; to tap a 100 per cent thread requires nearly three times the power for a 75 per cent thread. This probably applies only to certain kinds of material where the wedging ac-

The effect of rake angle on the cutting qualities of a tap is not in itself a mystery. But when upon this factor is superimposed a host of other variables, the problem becomes more complicated. As yet no mathematically exact solution has been found which considers all conditions. The author outlines the complexity of tap design and usage together with the advances that have been made in clarifying this important branch of shop tooling

tion in the tap teeth increases as the thread approached the maximum. An increase in tap breakage inevitably follows an increase in the percentage of tapped thread, other conditions being constant.

The National Screw Thread Commission has standardized the limits of the diameters of tapped holes in nuts, and these limits should be applicable to most internal screw thread manufacture. Drilled or punched hole sizes do not always remain the same after tapping because of reaming by the tap point or the tearing of the thread tops by chips which become lodged between the tap threads. This tearing is often apparent when soft stock is encountered or when an improper cutting fluid is used. Pitch and form of threads, coupled with tap diameter, must be considered in the regulation of tapping speeds. These factors have also a direct bearing on tap breakage especially for taps of small diameter.


Negative rake
Negative rake not practical for use in tapping steel
From 4° to 10° positive rake
Average rake in flutes for use in tapping all firm materials
More than 10° positive rake
Too much rake for normal conditions but to be used when soft and stringy stock is to be tapped
Very slight eccentric relief with insufficient clearance for continuous tapping
Eccentric relief to be used in average tapping
Rank flat relief causing tendency to chatter. Insufficient cutting edge support permits rapid breakdown
These distances the same on all lands
Relief ground evenly on all lands so that a balanced cut is taken and each tooth does its required share of work
Grinding the tap cutting face in the flute using a formed wheel

Tap life may be prolonged by correct sharpening which includes consideration of the material to be worked upon

Usually tapping emulsions cause a tap to cut closer to its own size than do cutting oils, even when used on the same material in the same machine. This difference must be taken into consideration by the tap user. When a steel, particularly nut stock, is low in sulphur content, the tap may tear the material leaving rough threads in the work, or chips may wad into a solid mass in the flutes. For such materials, the use of one of the better grades of mineral oil compounded with sulphur will permit the cutting of smoother threads, save tapping power, and reduce the amount of tap spoilage. A sufficient quantity of cutting fluid must be applied to eliminate all danger of dry tapping.

TO CUT labor costs during the past few years, many tap users speeded up their tapping machines far above the old recommended speeds of 30 to 35 feet per minute for carbon steel taps in machine steel. Some soon discovered that their tool costs and machine down-time were increasing faster than their expected savings in labor. These users have reduced their tapping speeds, but during this period, the tap manufacturers attempted to give their customers a carbon steel tap capable of holding up under the excessive requirements. As a result, tool quality was so refined that many carbon steel taps are operated today at speeds of 40 to 50 feet per minute. This practice is dependent upon both the material tapped and the cutting lubricant used. Some railroads still upon operating carbon steel staybolt taps, $1\frac{3}{8}$-, 1-, or $1\frac{1}{16}$-in. in diameter, with an insufficient quantity of cutting fluid through scaly boiler sheets at rates as high as 110 feet per minute. Tool efficiency is consequently low, and an average tool cost of one-quarter cent per tapped hole of the diameter given is not at all out of the ordinary.

When tapping speeds are required higher than carbon steel can normally stand, the obvious move is to use tools made of high-speed steel. In some instances, the tool cost per tapped hole is higher for high-speed steel than for carbon steel. This is usually caused by some factor other than speed, so the selection of tapping speeds cannot be made without due consideration to the material tapped, cutting fluid, pitch and form of thread, and the machine tool used.

The type of machine in which the tap is operated has its effect upon the size of the tapped hole, the condition of the tapped thread, the length of tap life, and the ratio of broken to worn out taps. The condition of the machine also affects these points. This is particularly true of the alignment of the spindle. With a bent spindle or one not in line with the hole to be tapped, it is quite impossible to control the size of the tapped hole. Special attention must be given the operation of automatic nut tappers which require bent shank taps. These machines must be kept in accurate alignment and be maintained in good general condition if correct nut sizes are to be obtained and tap breakage held to a minimum. The users of nut tappers have some special problems:

1. Good nut blanks must be supplied.
2. Proper tools must be used and set up correctly.

By good nut blanks is meant that these should be uniform, free from burrs, chips, and scrap, with well centered holes of reasonable size and roundness. Failure to maintain proper blank condition causes unnecessary down-time for the machines and an increase in tap breakage. Improper tools for the automatic bent shank tappers and incorrect set-ups have caused an untold amount of tap breakage as well as spoiled nuts, for which the taps have received the blame.

OCCASIONALLY for the so-called special tapping jobs, a tap manufacturer is given complete specifications for the required job together with samples of the material to be tapped and is asked to recommend the design of tap, operating speed, and tapping fluid. More often, more or less complete specifications are given and the tap is made to them without the manufacturer's knowing how the tool is to be used or the kind of material to be tapped. When trouble follows, which is frequent, the manufacturer's representative is called in and asked what his company is going to do about it. The representative attempts to obtain as complete analysis of the tapping

conditions as possible and the analysis is sent to the manufacturer's engineers who try to work out the problem in accordance with their knowledge of tapping principles. The recommendations for handling the job as a rule cover the points already outlined because one or more of the tapping considerations has been overlooked by the user.

Several problems of construction present themselves. First a choice must be made from a full line of carbon, the so-called semi-high-speed, and high-speed tool steels. A grade must be selected possessing the qualities of long cutting life, resistance to breakage, machinability in manufacture, and consistent hardening reaction in heat-treating. Hand in hand with the choice of steel, goes a knowledge of methods for its heat-treatment to develop the qualities needed in tap use. Not only must the thread end hold its keen cutting edge, but it must withstand the torsional strains of normal tapping and as many of the abnormal strains as possible. The shank ends usually require special hardening and tempering processes. For bent shank taps for automatic nut tappers, this process is intricate and adds to the tap cost.

A THREAD end must be chosen which is short enough to withstand the torsional stresses of tapping, yet long enough to permit the user to sharpen back the chamfer when the tap has become dull to obtain its maximum cutting life. The chamfer length is often limited by the hole to be tapped, such as the requirement of a plug point for a blind hole. It may be limited by other conditions such as the additional time necessary to tap a through hole when a long thread end is used. These limitations may be detrimental to tap life, but the user must balance tool cost against labor cost to determine the most economical design. Number, size, and depth of flutes are properties of importance upon which there is no general agreement. Many shop tests have been conducted and many conclusions drawn, but as in most questions of tap construction, the factors are too varied to permit exact knowledge. Although some users have expressed a preference for taps with an odd number of flutes, the difficulty of accurately measuring such taps has restricted their use. Many manufacturers and users cannot agree upon the question of rake. The manufacturer delivers his standard taps with flute angles he believes best suited for general purposes, hoping that when special jobs are encountered by the user, the taps will be reground to meet the specific requirements. After seeing some of the unbelievably inadequate flute grinding jobs, he may hope that the flutes be left as they are.

The threading of a tap presents a choice of methods —chasing, die-cutting, milling with single cutters, milling with multiple cutters or hobs, and grinding with an abrasive wheel. The threads may be cut before or after the flutes are milled, each method having its own problems. Threading before fluting entails the problem of placing relief in the threads and that of removing the burrs which are thrown up between the threads during the second operation. If the threading is done after the flutes are milled, the difficulty of measuring odd-fluted taps arises, but this has been overcome by some manufacturers by using special measuring instruments.

For many years, the question of tap sizes was not thoroughly understood. Only recently have taps been ordered to definite known diameters or to tap holes with definite tolerances. Previously taps were made the "same as sample," or "to tap sample," or to tap a nut to fit a sample screw. The standardization of nut and screw sizes as worked out by the National Screw Thread Commission has eliminated much of the guesswork from the sizes to be made but has brought other problems to the manufacturer of internal and external screw threads, and consequently to the tap manufacturer. The most difficult problem is that of generating and maintaining the sizes set up. The permitted tolerances usually are closer than those formerly used. Close tolerances promoted the adoption of better inspection methods. Tool manufacturers and users discovered that thread form and angles must be held within close limits and that lead errors must be reduced to a minimum if pitch diameter is to be maintained and a reasonable cutting life expected. The increased number of manufacturing specifications for more perfect size and form of thread has resulted in the grinding of threads after the tap is hardened to correct distortion. But here too, difficulty is encountered by both the manufacturer and user.

There are still many tapping jobs where ground-thread taps of certain designs have not proved themselves superior to cut thread taps, because in tapping certain materials, the sides of the tap threads become loaded with fine particles. These adhering particles build themselves into solid masses which interfere with free tapping action and result in the tearing of the threads in a tapped hole and the shortening of tool life. The almost perfect alignment of teeth in a ground tap apparently permits the teeth to trim the sides of the threads thus enlarging the space between threads to produce a loose fit.

Regardless of the design of tap supplied, the user cannot expect the tool to continue to give good cutting results unless it is handled correctly and maintained in good condition. A tap, which becomes bent so the thread end does not revolve truly with the tapping machine spindle, will cut larger than its own size. Such taps must be straightened or removed from service. Tap users have found it impossible to purchase a grinding machine which can be reset quickly to sharpen taps and in which taps may be ground accurately without putting the tool on centers. In many shops, taps are reground by hand or are not sharpened at all. Dull taps will not cut good threads, and tap breakage usually results. Often a tap sharpened improperly is just as bad as a dull one. There is no one best way to sharpen taps upon which everyone agrees, but certain known principles apply.

Tap grinding as a rule consists of three operations:

1. Grinding in the flutes with a formed wheel
2. Grinding the chamfer
3. Cutting off the tap point

In grinding the flutes, the important point is to generate or maintain the proper rake. In grinding the chamfer, all lands must be the same height so each does its proper share of work and the proper clearance or relief must be given outside the lands. Too much relief is likely to cause chattering and to leave chatter marks in the tapped holes. The camming action caused by chattering reduces the size of the tapped hole below the actual pitch diameter of the tap. The weakness of cutting edge support caused by too much relief causes the cutting edges to break down prematurely. In cutting off the tap point, every precaution should be taken to prevent drawing the temper of the steel. This applies also to the other grinding operations.

Proper equipment for tap grinding should be available in every plant where taps are used. Such equipment must be kept in good condition if grinding is to be controlled and a smooth surface obtained. Only then can the tap adequately meet the tasks placed upon it.

ENGLISH PRACTICE IN REPAIR WELDING

A. ANDREWS
Manchester, England

WELDING, in the past decade, has become one of the most reliable methods for the repairing of worn and fractured parts. Whether fabricated from aluminum, brass, copper, gray or malleable iron, or steel, such parts can be restored rapidly to full and permanent service.

Engine cylinders, which only a few years ago would have been scrapped, can be repaired equal to new by fusion welding, even though their bores are scored or cracked, or parts are broken out, and this without altering their size or causing distortion. Crankshafts which might be considered fit only for junk can be built up to their original size and strength. Teeth made of 3 to 4 per cent nickel steel can be built onto pinions from which they are missing. Shafts with splines badly worn can be rebuilt and the splines recut, the extra metal employed being equal in strength and quality to that of the original shaft. Burnt valve seats are readily built up (usually with bronze) and recut and crankcase arms are welded, and if necessary, strengthened by additional webs to obviate future breakage.

The importance of making the proper preparation for a weld cannot be over-emphasized. Time spent in preparing the work adequately before welding is amply repaid afterwards in the easier execution made possible by it, and also by the homogeneous nature of the weld. Clean metal makes a stronger weld than one in which impurities are present. Scale, rust, grease, and foreign matter will contaminate any weld; foreign inclusions necessarily weaken it or make it hard or brittle. Foreign matter may also prevent the added metal from filling the joint.

For a permanent repair in motor coach aluminum castings, the writer favors oxyacetylene welding. With most other metals electric welding is, perhaps, more effective, because the heat is produced within the work, whereas torch heat is applied from without. Where work is suitable for the electric arc, repairs can be made more quickly than by oxy-acetylene torch flame, but this does not apply to aluminum parts. In the writer's opinion, "puddle" welding for repairing aluminum castings is not satisfactory, because the aluminum oxide has a higher specific gravity than the metal and tends to sink to the bottom of the molten puddle, involving risk of oxide inclusions in the weld. Moreover, the method is somewhat slow and therefore costly in gas and labor. A flux is an important factor when welding aluminum castings, as it dissolves and de-oxidizes the oxide layer and protects the metal from further oxidation during the welding operation.

Welding rods should be of approximately the same composition as the casting welded. For the strong aluminum alloys, a welding rod containing approximately 95 per cent aluminum and 5 per cent silicon is about right. No. 23 Oxweld rod coalesces readily with all aluminum casting alloys and possesses high strength and good corrosion resistance.

It usually is necessary to preheat and anneal cast aluminum parts to prevent too rapid expansion and contraction of the metal. Preheating also conserves gas, increases the rate of welding and prevents distortion. The preheating temperature for aluminum alloys is about 850 deg. F. Higher temperatures yield no advantage and should be avoided, as distortion and warping may result. Welding operators generally can tell when the correct preheating temperature has been reached by rapping the casting. A cold aluminum casting gives a metallic sound when struck, but as it becomes hot, the metallic sound grows less and less perceptible. An indication of overheating is the formation of little beads or globules on the casting alloys. A better test is to apply dry sawdust. When the correct temperature has been reached, the casting begins to char the sawdust. With this method the welder can tell at a glance whether the casting is being heated uniformly.

It is not essential, however, to preheat all aluminum alloy castings prior to welding. The corner broken off the flange of a crankcase or gearbox, for example, can be welded perfectly by commencing to heat up the corner with a torch flame, giving it sufficient time for the heat to radiate, and welding it when at the right temperature. When the welding is completed the flame should be manipulated gradually away from the weld toward the corner of the crankcase or gearbox to compensate for expansion and contraction.

After welding an aluminum casting, it is essential that the weld and nearby areas be washed with hot water to remove all traces of the flux, thereby preventing subsequent corrosion of the metal.

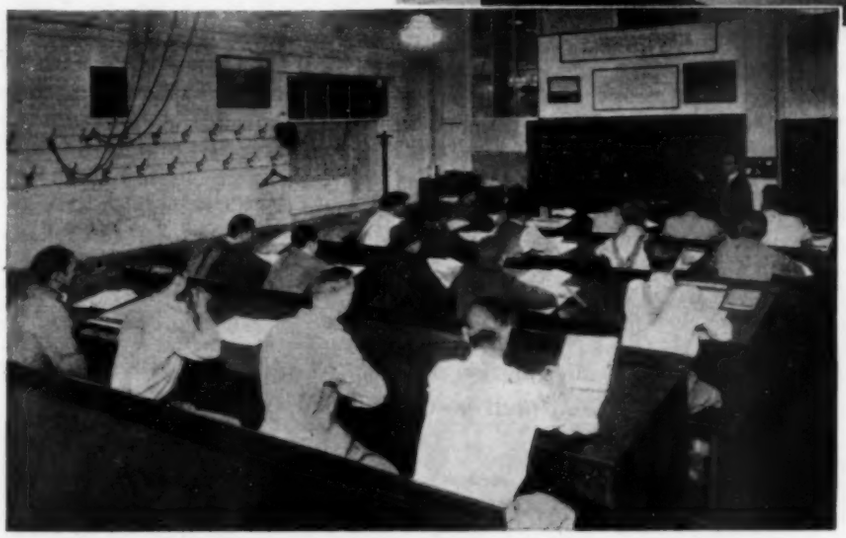
When a new part is to be welded into an alumnium casting between the edges of a fracture or break, it is desirable that the new metal should have the same chemical composition and physical properties as the rest of the casting. Often it is economical to utilize parts from scrap castings of the same composition as the damaged piece.

The present group of 125 apprentices and 5 instructors

Training Tomorrow's Technicians

APPRENTICE training is receiving an increasing amount of attention from far-sighted industrial executives. At the last A.S.M.E. annual meeting, an entire session was devoted to this subject. Here are several new views of the apprentice school of the Caterpillar Tractor Company.

Checking sample castings in the Receiving Inspection Department, during the 4-month layout period of the course



A lesson on form tools in the classroom for related subject instruction. One hour a day of each boy's time is devoted to classroom work

The Foreman's Round Table

THE END OF THE ROAD

WHEN Ed opened his morning mail he found among it a numbered notice marked, "To be posted." It read as follows:

"Hereafter, rough grinders, rough drillers, and men for similar work will be chosen, as far as possible, from among our laborers and material handlers. New men will be hired as laborers, instead of to fill the higher positions. All laborers will be subject to draft by any department needing them for better work at increased pay. Hereafter, we shall also give preference, in any position they can fill, to men holding other positions in the plant. It is our desire to promote those within our employ and consistently to increase their usefulness."

Ed managed to contain himself until he met his friend Al at lunch time.

"Say, Al, what's the idea of all the notices Williams is flooding the shop with? I thought he did not believe in notices."

"He doesn't, but he is making up a file of accepted practice. You'll notice the notices are numbered, and most of them are about things we have always done. These notices merely put the rule on record. After they are all written each of us will get an indexed folder with them in."

"Well, Williams and I are even; he don't believe in posting notices, and I don't believe in the notices he's posting. I thought they were some of those 'letters from a self-made merchant to his son,' that a guy named Lorimer used to write."

"Yes, son, and if you had imbibed all the good shop sense in those letters you talk about, you would have a liberal education."

"Is that so? Anyway, it hasn't got nothing to do with this particular notice. I agree with Joe Cook that no one has a right to steal men that one man has trained and give them to some other department."

"Heaven send me patience. That particular notice puts into effect the principles that you and Joe Cook both advocate, and yet you kick."

"Gee, Al, don't class me with Joe. I think for myself, but sometimes my opinions agree with those of other people; even you. But I'm not going to have you or anyone else steal good men that I have trained."

"Half-cocked as usual. The idea of that notice is to allow every man to move up until he has reached the end of his usefulness. Just take my own department. I've got some mighty nice boys in it that don't belong there. I'll hate like blazes to lose them but I must promote them. Not to do so would make me feel like the dog in the manger, and they'd quit anyway. The only thing for those young fellows is to transfer to some department where they will eventually get paid for knowledge rather than skill."

"Why not give them an increase? That's your weak spot, Al, you don't believe in increases."

"Yes, I do, but no company can be successful and run its payroll on sentiment. Each class of labor must be paid in definite relation to some other class. When you have reached that limit something else must be done or the company loses good men."

"But I still don't agree that you are doing anything. What is the difference between giving a man an increase of two cents an hour and boosting him into a position that he can't fill?"

"The notice is not intended to convey that idea. We have many men that have reached their limit in the company. We have others that have only reached the limit of pay increases in the particular position they occupy. Why should we lose them, when we know they are good men? The others must learn that each man has a niche into which he fits, and that niche is sometimes at the end of the road."

Is it right to hold out the promise of unlimited opportunity? How can a man be tactfully advised that he has reached the maximum of his usefulness? Who shall designate who shall be transferred?

▸ ▸ ▸ Discussion of Former Topics

Who's Who in Industry

When Ed walks through the automatic department and feels like raising his hat, he wants to be sure that none of the operators are present.

Contrariwise, in going through the blacksmith shop he should wait until the smiths are present before performing the uncovering act, otherwise he will run a great risk of paying homage where no homage is due.

Joking apart, it is obvious that the difference in skill necessary to carry out different jobs is not sufficiently recognized, and the injustice is intensified to a great extent in England by the insistence of the trade organizations on a fixed minimum wage.

If an employer is forced to give a certain wage to a man who is obviously not worth it, there is a great temptation to refrain from paying his good workmen any more than he is forced to do.

Thus the minimum wage also becomes the maximum wage.

In 12 years' experience in control of ratefixing the writer has frequently been faced with the injustice of the recognized method of payment, which does not differentiate sufficiently between jobs requiring great skill and others requiring considerably less.

While the consideration of different rates of pay does not exactly come within the purview of the ratefixer, some extra allowance for the preponderance of the human element factor can be made where it is obvious that the work requires a high degree of skill.

Looking at the matter from another angle, it is often found that, where the provision of special equipment has taken the skill out of a job, it has added to the physical effort required to keep it going.

Thus, in operating a correctly tooled multi-spindle machine the operator is kept busy loading and unloading with no opportunity to enjoy a rest while his "self act" is operating, whereas in a job requiring a high degree of skill the physical effort is often restricted to the manipulation of light machinery or instruments, such as in gauge making or inspection.

The variations encountered in this direction differ with each concern, and the solution of the difficulties can only be dealt with by the man on the spot, the success or failure of such solutions being dependent entirely upon the perspicacity of that individual.

—A. Williams, *Bristol, England.*

From Another Angle

The relation of views on a drawing is such that the right-hand end view is shown at the right of the drawing. Any other arrangement would be inconvenient unless one had a part to roll over and compare with the drawing. The request for first angle projection comes from the shop where they want to roll a part over to the left and find the exposed side shown at the left of the main view.

The practice of having a note on drawings limiting tolerance dimensions on finished surfaces to plus or minus 0.010 in. is passing out in some shops, largely because the draftsmen let it cover dimensions which should have plus or minus 0.020 in. or plus or minus 0.005 in.

There are cases where blue prints hold their size close enough to be scaled, but scaling from blue prints generally is a dangerous practice.

A note giving unspecified radii as $\frac{1}{8}$ in. and wall thickness as $\frac{3}{16}$ in. often is a great time saver.

The proper dimensioning of the parts of a mechanism is a ticklish problem. Tolerances have a way of accumulating, and all sorts of dimensioning kinks must be used, but it is usually possible and practical to get related dimensions together.

—Harry I. Hazzard, *International Harvester Company.*

The Wail of the Weak

Co-operation is what you give; not what you get.

I think Al's boss was right about two of his errors, but wrong about the right kind of co-operation. The right kind of co-operation is independent parallel operation, or merged activity, as the case may require. No engineering department will ever be able to design all parts the way the shop wants to make them. Very few shops can make some of the parts the way the engineering department designs them.

If people would only acquire the ability to forget themselves, forget their department, forget their boss, and work for the company, problems such as these would disappear. It is not a question of who is right, but of what is right. Co-operation consists of two people working together to the end that the then divergent personal views emerge as one view of what is best to be done under the particular circumstances involved.

—William A. Walter.

The Fortune Teller

Most criticisms of psychological examinations come from those who do not understand the purpose of them. They are not supposed to find out what a man can do. A foreman can tell whether a man is a good machinist far better than the psychological examiner. But where the ordinary foreman fails is in telling whether an inexperienced man is going to become a good machinist, or whether he would be placed better elsewhere.

A farmer, who has lived for 40 years on a farm, comes to the city for work. The employer recognizes him as a good man but with no experience that is of value to him. Should he spend time trying to make him into a machinist, or would that be waste?

A boy comes directly from school. Should the em-

ployer try to make him into a machinist, a foreman, an office clerk, a draftsman, or should he leave him as unskilled labor? These are the kind of questions that the psychological tests are intended to answer.

In order to solve these problems, all must be placed on an equal footing; that is, tests must be made that are new to all or that are common to all. Questions may be asked that all have heard the answers to but which only a few will remember. That shows what the person is interested in. Or questions may be asked that no one has ever heard of before.

The trouble with the tests, as I have seen them, is that the makers of the tests do not know enough about the jobs to ask the right kinds of questions. I am told that for certain of the simpler jobs, tests have proved quite satisfactory. But, for the present, the job is to test the tests rather than to test the applicants. If this is done regularly, in time it should be possible to get up tests that would furnish a reasonable prediction of what the applicant might learn to do.

—A. W. Forbes,
Forbes & Myers.

A Friend at Court

There is a lot of truth in the old saying: that "The farther you stay away from your relatives and friends the better off you are."

When times are hard and you are laying off men it does not look good to bring in a friend of the boss and make him an assistant. Moves like this on the part of management cause dissatisfaction among the men. Ed's remark that he never has trained anyone for his job shows shortsightedness on his part. Now would be a good time to train one. This would release a man from production and might save laying some one off.

—T. M. Garry,
Yale & Towne Manufacturing Company.

The Exception to the Rule

I believe the practice of cutting piece prices justified, provided there is a logical explanation publicly given the men at the time the cut is made. Logical explanations might include an inability to sell at a profit because the piece rate is too high as compared with competitors, the inability to maintain full production at current prices because of a slump in demand, saturation of the market at current selling prices, etc. In fact, all these logical explanations are centered on the inability of the company to make a reasonable profit at prevailing piece prices. The fact that it is believed the men are making too much money is not, *per se*, either a justifiable or ethical reason for a piece price cut. It may, however, be justified if there is a sudden jump in production due to new or better equipment, when a reasonable readjustment may be in order, for as soon as competitors likewise equip, the selling price will be forced down, and it is better to anticipate before customers are lost.

The earning power of different men is not primarily the concern of their employers, particularly since the best type of men in any endeavor of life usually work on their own. However, if it is felt desirable for the mental good of an organization to reduce the pay of the one or two outstanding men who are far ahead of others in productive capacity, this can be readily accomplished by a sliding scale. This might take many forms, the simplest being a certain price rate up to a certain daily quantity, the rate above that quantity being lower. This is how it might be done, although I do not advocate it, for I believe that to be strictly logical, the piece rate above this fixed quantity should be even higher, since machine cost and overhead are saved. Higher rates rather than lower ones would be in order.

—N. Nichols.

Trade Secrets

A new idea, be it a formula, a process, or something patentable, first belongs to the man who originates it. The final disposition will depend largely on what business connections exist and what agreements have been entered into.

A common practice is to have all employees who are likely to develop patentable ideas on the firm's product, sign off their claims in advance. No special compensation is given for the ordinary run of claims for patent. It is natural that a man becomes more secure as an employee when he has several patents to his credit. This is not only true because of the possibilities of more good ideas, but any firm knows that the best man to get around a patent is the man who originated it, when employed elsewhere.

Direct compensation for a major patent may come either from outright sale or royalty. Sale is best on small volume possibilities. Royalty is more of a gamble, but if large sales are realized it makes a continuous income for the inventor.

—L. F. Swenson.

The Wail of the Weak

I think Al's old boss was right about only one of his errors, that of looking upon system as a definite control whereas it is only a rule procedure. That is an error many people make, and it takes real ability and experience to discover its fallacy. About co-operation and co-ordination, I believe he is still in error. Of course, many a popular word becomes distorted in its meaning, since weaklings have a habit of grabbing it as an alibi for their difficulties. A reference to a dictionary will do much to disabuse one of the popular misconceptions of the meaning of co-operation. It is defined as "a working together." Surely no one will deny its real desirability in an organization.

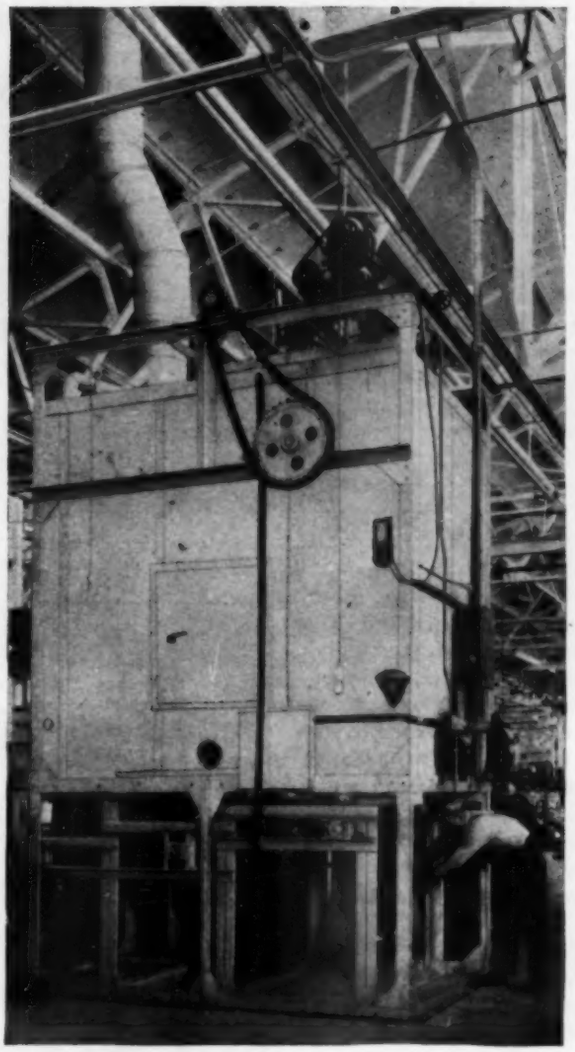
Al himself is wrong in considering co-operation as industrial charity. It's a prop and not a crutch. Co-operation is working on a job with the true ultimate objective always in view, not merely doing that which on the face of it keeps oneself clear, and registering utter indifference of the effect on the other fellow. It's also being eternally alert for errors and improvements, even though one's own orders are restrictive, and it's going out of one's own way to aid the ultimate job.

Co-operation decidedly means independent parallel operation rather than merged activity. As long as it is kept so, and there is no shifting of responsibility under the guise of co-operation, then it is successful. If, however, it were to imply a lumping of responsibility so that everyone is jointly responsible, and no one is truly so in the final analysis, then it would be a failure.

—Nicholas Richard.

Electric Ovens for Aircraft Engine Parts

PHILIP KRIEGEL
Gehnrich Oven Company, Inc.



Two-strand vertical loop conveyor oven for japanning cylinder assemblies, Curtiss Aeroplane & Motor Company

HEAT-TREATMENT of aluminum alloys used in the construction of airplanes and airplane motors has become an exact science, requiring the design and construction of a large variety of ovens for the many types of work handled. The fundamental requirements for equipment are accuracy of temperature control, uniformity of heat distribution, ease of operation, cleanliness, safety, economy in handling, and non-delivery of products of combustion to the surrounding atmosphere. Considering these requirements, electric ovens are a logical solution.

For example, in the production of Wright "Whirlwind" and "Cyclone," Curtiss "Challenger" and "Falcon," and Pratt & Whitney "Wasp" and "Hornet" motors, electric ovens are used exclusively for low-temperature heat-treating of cylinder and crankcase parts and for baking japan and enamel finishes on motor assemblies. These particular ovens were designed, built, and installed by the Gehnrich Oven Company, Inc., using electric heating equipment manufactured by General Electric.

Half the poundage of the modern aircraft engine is represented by aluminum alloys. Heat-treatment of these alloys embodies two stages, the solution treatment, and the aging treatment. In the former, the alloys are heated at temperatures above 950 deg. F., then quenched in water, oil, or air to improve their hardness. However, they do not attain maximum strength by this treatment, and it is necessary to submit the metal to aging at moderate temperatures, from 200 to 500 deg. F., depending on the composition of the alloy and the size, weight, and type of casting. This treatment gives the piece maximum tensile strength, greatly increases the proportional limit, and improves resistance to corrosion.

At the Wright Aeronautical Corporation, Paterson, N. J., a truck loading oven of insulated dual-panel construction is used for aging. It is 9 ft. wide, 9 ft. long, and 7 ft. high, handling two trucks abreast, each 3 ft. wide by 6¾ ft. long, upon which parts are loaded. The oven is electrically heated with a connected load of 60 kw. and is provided with automatic temperature control. By means of a special horizontal-heat-flow, disk-cam circulating system, the temperature is kept uniform throughout the oven, with a variation of less than 5 deg. F. The actual operating range is 200 to 700 deg. F., with the crankcase parts being treated at about 300 deg. F. for 4 hours, the cylinder heads and pistons at 400 deg. F., and other parts as high as 700 deg. F.

An important heat-treating operation in the assembly of cylinders is that of preheating the finished head fin bodies prior to shrinking them on the steel cylinders. At the Wright plant, an electrically heated, continuous, slat-conveyor oven is used. This insulated steel panel oven is 4 ft. 10 in. wide, 9 ft. 2 in. long, and 4⅓ ft. high, with over-all conveyor length of 12 ft. Lift doors, powered by motor-driven winches at loading and unloading ends, are provided. The conveyor is two matched strands of roller chain with cross bars and steel apron belt, to which are secured spacer angles. It is driven by a variable-speed drive. Operation of the oven is entirely automatic. Three heads having been removed at the unloading end for shrinking, a button is pressed which raises both doors simultaneously. When these doors have opened the conveyor moves forward a predetermined distance and stops, thereby presenting three additional cylinder heads for discharge and charging three cold heads previously placed at the loading end of the conveyor. After loading, pressing of another button causes the two doors to be lowered, and the cycle is repeated. Heating is entirely automatic, incorporating a connected load of 45 kw., controlled by automatic thermostats provided

with heat-cycle recorders. Operating temperature is 750 deg. F., with a heating period of 48 min.

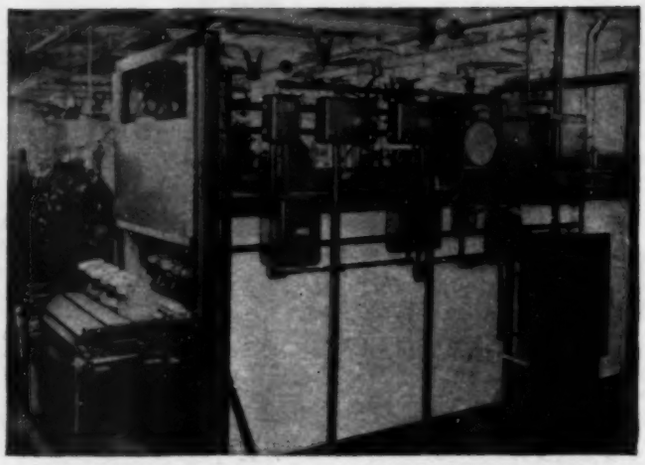
At the Curtiss Aeroplane & Motor Co., Buffalo, N. Y., a continuous, two-strand, reel-type conveyor oven is used for the shrinking operation. Occupying no more space than an ordinary small box-type oven, this unit is 6½ ft. wide, 9 ft. long and 11 ft. 2 in. high, constructed of insulated steel dual panels. The conveyor consists of subway grating carriers, suspended from pipe rods attached to two matched strands of chain which move continuously in vertical loops over sprockets. Conveyor travel is timed so that the operator can open the door for loading and unloading at definite periods. Heating equipment consists of 30 kw. in ribbon heaters mounted on the floor of the oven. The operating temperature is likewise 750 deg. F., regulated by a controlling and indicating thermostat.

Three additional ovens are used at this plant for other preheating and annealing purposes. Two of these are drawer-type ovens, one consisting of six drawers and the other of four, running on overhead tracks, thereby eliminating any floor obstructions for supporting the drawers when pulled out. These electrically heated ovens are of the usual dual-panel construction, with insulated walls, roof, floor, and drawer faces. The other oven is a truck-loading type, electrically heated with a connected load of 52 kw. and automatic temperature control, also operating at temperatures to 750 deg. F. These ovens are used for preheating and annealing cast aluminum alloy pistons and miscellaneous parts.

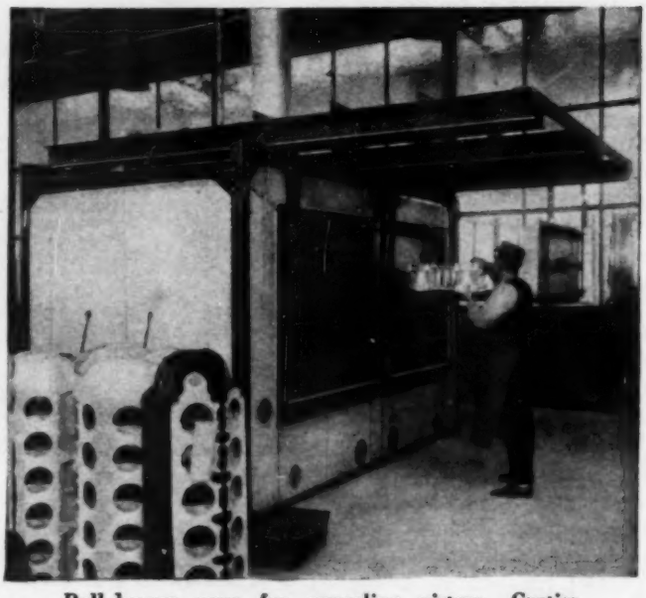
Preheating for shrinking of cylinder heads is accomplished at the Pratt & Whitney Aircraft Company, Hartford, Conn., in several closet-type electric ovens. These are each 40 in. wide, 34 in. deep, and 77 in. high, of standard panel construction and ventilation, and with a connected load of 15 kw. per oven. The load in the oven varies from a few castings to a maximum weight of 90 lb., subjected to a temperature of 550 deg. F. under thermostatic control for a period of 4 to 5 hours.

The last operation before motor assembly involves finishing of the parts in japan or enamel. Cylinders are sprayed with black japan; crankcases and other parts are finished by brushing on a gray enamel. At the Wright plant, cylinders are baked at 450 deg. F. in a two-compartment, truck loading oven, while crankcases are baked in a three-compartment oven at 250 deg. F. The former is 4 ft. 10 in. wide, 7 ft. 2 in. deep, and 6 ft. 8 in. inside each compartment, with insulated walls, roof, doors, and floor. The connected load is 40 kw., consisting of heaters mounted at the side walls of each compartment. Each compartment is provided with fresh air intakes and distributing ducts and exhaust ducts connected into a common header, equipped with a motor-operated exhaust fan for discharging japan fumes. The oven is fully provided with full electrical regulating equipment, such as switchboard, door switch for cutting off power when the doors are open, time switch for automatically starting heating of the oven or cutting off heat at any predetermined time, and indicating and controlling thermostats. The three-compartment enameling oven is similar in size, construction, and equipment.

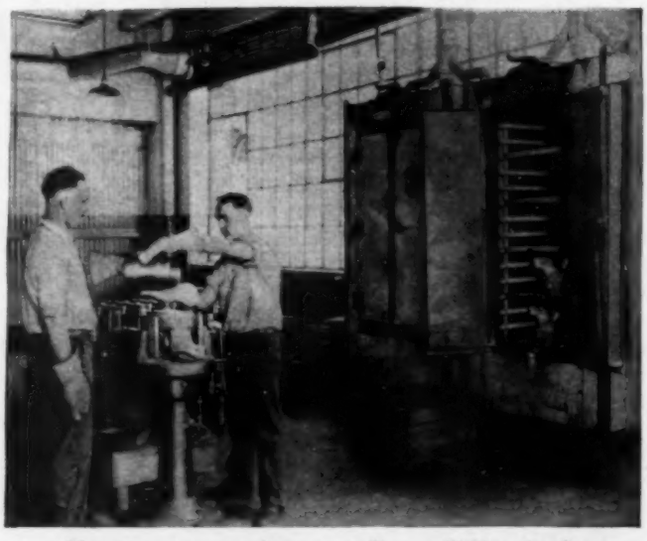
The japanning oven at the Curtiss plant is similar to the conveyor-type shrinking oven. It is 5 ft. 3 in. wide,



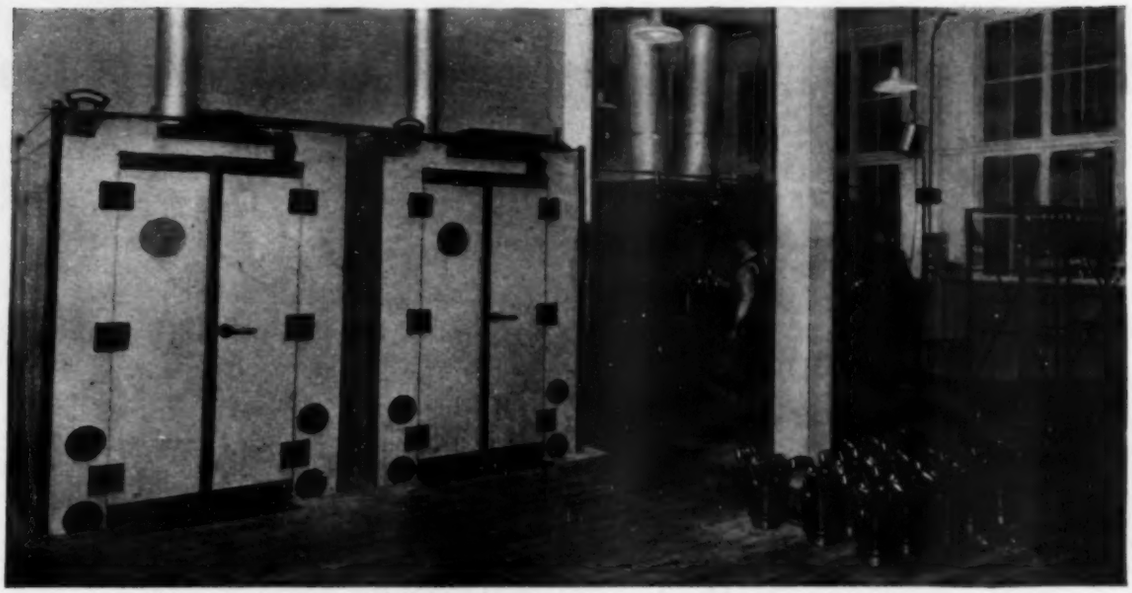
Horizontal conveyor oven for preheating castings before shrinking, Wright Aeronautical Corporation



Pull-drawer oven for annealing pistons, Curtiss Aeroplane & Motor Company



Closet-type ovens for expanding cylinder heads previous to shrinking on steel cylinders, Pratt & Whitney Aircraft Corporation



Two of a battery of eight truck loading ovens for baking enamel finishes on cylinders and other parts, Pratt & Whitney Aircraft Corporation. The businesslike spray booths and clean floor are notable

8 ft. 7 in. long, and 12 ft. 1 in. high, of standard panel construction. Sprayed cylinders are loaded on subway grating trays suspended from cross-flights attached to two strands of chain. These strands move continuously over sprockets in vertical loop fashion. This method of conveying the material through the oven saves considerable floor space which might otherwise be required in any method of horizontal conveyor travel. The conveyor is driven by a power unit consisting of a motor, reduction gear, and variable-speed transmission for moving the conveyor at the speed of whatever heating cycle may be desired. Electric heaters with a connected load of 45 kw. are mounted on the oven floor, while suitable ventilation is provided through fresh air intakes at the bottom and exhaust at the top. Oven temperature is 400 deg. F. maximum, regulated by an indicating and controlling thermostat.

Cylinders and other sections of Pratt & Whitney motors are japan sprayed and baked in eight standard truck-loading electric ovens, automatically controlled, at a temperature of 450 deg. F. maximum, similar to the Wright ovens previously described. The baking time is three hours after heat is brought up.

■

Machine Morgues

ROBERT TWEEDSIDE

MANY FIRMS have a regular morgue for discarded machinery and equipment. Some of this is admittedly obsolete, while some was removed from service temporarily, as it was thought at the time, but has never achieved reinstatement. Here is found an ingenious but complicated failure, the pet extravagance of a forceful official, an ironic monument to a costly folly. Such relics had better be scrapped, but the human weakness to postpone definite acknowledgement of failure allows them to linger on. Pet ideas die hard—even the best inventors have been known to pursue will-o'-the-wisps.

In a small firm, controlled by an erratic rule-of-thumb boss, all the unsuccessful or incomplete mechanisms were stored away in the vain hope that they might some day be used in modified form. When a new scheme was evolved, the boss and the foreman went to the store and sought to find old parts as a basis for the new device. Much time was wasted in this futile effort, and the flow of fresh ideas was clogged by a confusion of old ones.

The morgue may be located in an old, leaky shed or a dark, dismal basement, silent as the grave, where these dignified relics slowly rust themselves to death in irritating disarray. This limbo of forgotten things is a depressing sight to a lover of useful humming machinery. A solemn stillness holds the air as one walks among the dusty, rust-, or grease-covered outlines as though among tombstones. The thought comes that sepulchral music would be a fitting accompaniment.

Here and there the sight of a familiar object may bring to mind a bygone problem, overcome with difficulty, only to be superseded by a more lasting solution. Perhaps that huge mass of old metal in the corner once turned out good work until a new machine, taking half the floor space and producing twice as much, crowded it out. After a gloomy survey of these antiques, one returns to the outer air with a distinct sense of relief. The sun is shining and the invigorating hum of busy workshops greets the ears.

If you have such a deadhouse of useless equipment, look it over now. Weed out those pieces having only scrap value. Sell them to the junk dealer, or break them up for the cupola. Realize what you can and dispel the gloom that old and discarded machines produce.

Then look over the machines in use in your shops. Some may qualify for the morgue and may be doing far more harm than those quietly rusting away. Oust them and substitute modern tools. Then you will be ready for the busy times ahead.

AMERICAN MACHINIST 1930 INVENTORY

of Metal-Working Equipment

THIS group covers bakers', bottling, canning, coffee roasting and grinding, confectionery, ice cream, flour- and grain-mill, oil-mill, packing-house, slicing, and sugar-mill machinery. Despite this variety of product, the amount of machine tool equipment in food machinery plants is relatively small, having a total under 12,000 units. This figure exceeds that reported for makers of construction equipment in Report No. 13 (Vol. 73, page 748) and hydraulic, mining, and oil-well machinery in Report No. 14 (Vol. 73, page 786) but is smaller than those for the other groups published to date.

Report No. 19—Plants making food machinery

Food machinery manufacturers were included in the miscellaneous classification in 1925, so a direct comparison cannot be made between their status then and now. The 46 per cent of machines over ten years of age is two points higher than that shown for all industries in the last inventory.

PER CENT OF MACHINES INSTALLED
Prior to 1920
1920-1929
PER CENT OF TOTAL IN EACH MACHINE GROUP
Presses, Power 27 73 12.6
Turning 60 40 10.6
Drilling 56 44 9.3
Grinding 47 53 8.9
Milling 61 39 8.4
Cutting-Off 42 58 4.6
Shapers and Slotters 67 33 3.1
Shears 44 56 2.7
Planing 59 41 2.2
Boring 29 71 2.0
Bending and Straightening 49 51 2.0
Gear Cutting 44 56 1.9
Welding 100 1.7
Riveting 27 73 1.6
Presses, Hand 70 30 1.5
Threading 50 50 1.6
Polishing, Lapping, and Honing 46 54 1.4
Keyseating 47 53 0.7
Forging 9 91 0.6
Centering 30 70 0.6
Hammers 44 56 0.5
Wire Forming 100 0.5
Broaching 75 25 0.2
AVERAGE 46 54

Machines for Making Food Machinery

	Total Number in Plants 1930	Number Installed Before 1920
LATHES		
Engine	1,127	683
Hand Turret	205	179
Power Turret	139	13
Automatic and Semi-Automatic	99	86
Chucking (Not Chucking Machines)	119	93
Speed and Bench		
Crankshaft		
Toolroom Type	73	27
Other	73	7
CHUCKING MACHINES (Not Chucking Lathes)		
SCREW MACHINES		
Hand	53	27
Automatic, Single Spindle	20	20
Automatic, Multiple Spindle	33	33
CENTERING MACHINES	66	20
MILLING MACHINES		
Hand (No Power Feed)	80	46
Bench	20	20
Plain (Knee and Column Type)	345	186
Universal (Knee and Column Type)	172	86
Vertical (Knee and Column Type)	133	80
Lincoln Type Manufacturing	119	93
Continuous, Rotary Table or Drum Type		
Planer Type	93	66
Other	46	27
GEAR CUTTING MACHINES		
Rotary or Milling Type	80	40
Hobbing	66	27
Planing or Shaping	80	33
Other		
BORING MACHINES		
Horizontal Boring, Drilling and Milling	146	33
Vertical Boring Mills	40	13
Other	33	13
JIG BORERS	13	7
DRILLING MACHINES		
Radial	371	119
Upright, One Spindle	835	497
Upright, Two or More Spindles	40	13
Upright Gang (Two or More Heads)	33	27
Sensitive, One Spindle	265	192
Sensitive, Two or More Spindles	73	60
Sensitive Gang (Two or More Heads)		
Two, Three and Four Way		
Other	53	20
THREADING MACHINES		
Single Spindle Tapping	27	13
Multiple Spindle Tapping	80	40
Pipe Threading and Cutting	40	33
Bolt Threading and Cutting	33	7
Thread Chasing	7	
Thread Hobbing and Milling		
Thread Rolling		
Other		
PLANERS		
Open Side	46	13
Double-Housing	212	139
SHAPERS		
Vertical	18	7
Horizontal	318	212
Slotters	27	20
KEYSEATING MACHINES	86	40
BROACHING MACHINES	27	20
GRINDING MACHINES		
Plain Cylindrical	66	40
Universal Cylindrical	99	33
Surface, Reciprocating	73	40
Surface, Rotating	86	33
Internal	53	33
Crankshaft		
Cutter	159	73
Floor, No Feed Attachments	345	179
Bench, No Feed Attachments	73	27
Abrasive Disk	146	27
Abrasive Belt	60	46
Centerless	7	7
Other	113	60
POLISHING AND BUFFING MACHINES		
(Including those in Plating and other Depts.)		
Abrasive Wheel, Hand Operated	99	66
Abrasive Belt, Hand Operated	46	
Automatic and Semi-Automatic	13	7
LAPPING MACHINES		
HONING MACHINES		
CUTTING-OFF MACHINES		
Parting Tool Type	13	13
Power Hack Saw	272	119
Rotary Cold Saw	99	80
Bandsaw	66	7
Other	86	7
WIRE FORMING MACHINERY		
Spring Coiling	53	
Other	7	
WELDING AND CUTTING MACHINES		
Resistance Welding, Butt	20	
Resistance Welding, Spot	20	
Resistance Welding, Seam	7	
Resistance Welding, Other		
Arc Welding	126	
Electric Cutting	27	
Gas Welding	13	
Gas Cutting	7	
RIVETING MACHINES, STATIONARY		
Pneumatic	66	20
Hydraulic	20	7
Power	133	33
PRESSES		
Punching Machines	199	126
Combined Punches and Shears	53	27
Hand, Arbor	172	119
Hand, Light Punch Press Work	13	7
Foot, Light Punch Press Work	33	27
Power, Crank Type	1,929	418
Power, Toggle Type	27	13
Power, Double Acting	7	
Power, Dieing Type		
Power, Trimming Presses	7	7
Power, Forcing, Arbor, Wheel		
Hydraulic, Bending, Forming, Drawing	53	20
Hydraulic, Wheel Forcing, etc	13	13
Baling, Power and Hydraulic	13	
Other		
BENDING AND STRAIGHTENING MACHINES		
Bending Brakes	93	60
Bending Rolls, Horizontal	93	33
Bending Rolls, Vertical	20	20
Straightening Rolls	7	
Other	20	
SHEARS		
Knife	186	99
Rotary, Slitting	106	33
NIBBLING MACHINES	27	7
HAMMERS		
Drop		
Helve	13	
Spring	20	20
Steam	27	7
Pneumatic (not portable)		
Other		
FORGING MACHINES		
Bulldozers	20	7
Hot Forging Machines	33	
Cold Headers, Bolt, Nut, etc.	7	
Cold, Swaging	7	
Forging and Flanging Presses, Hydraulic		
Other Forging Machines	7	
Total	11,741	5,450

IDEAS FROM PRACTICAL MEN

Another Shaper Job

The remaining 3 of 11 discussions. Eight other contributors gave their solutions to the problem in this department last week

C. W. HINMAN
Chief Tool Designer, Kobsy Tool Company

IN OUR die shop we have three shapers constantly in use finishing tool steel die blocks and rectangular sections for large dies. It has always been our practice to square up the blocks in the shaper vise by the use of a good square, a steady hand, and clear eyesight. If greater accuracy is required the blocks can be surface ground and thus squared properly by several methods. In fact, I should think that any die block requiring such accuracy as your contributor describes; where it is necessary to use all four sides in laying out the die form, ought to be ground on at least one flat side and all the four edges when taken from the shaper. By so doing there would be an excellent opportunity for squaring on the grinder, on which machine there are several good methods for squaring the blocks, aside from using an accurate square. However, I am aware that grinding these blocks for squaring might be too good in this case, besides it might spoil this perfectly good shaper problem. Therefore we will have to consider some other way.

I understand that your contributor's shaper and its vise are in "good trim" and will finish parallel sides or edges perfectly, but that he cannot get accurate work when using the swivel graduations on his vise, therefore I would say don't use this feature at all.

By all means the 8 x 8 in. flat sides should be shaped parallel first before any of the edges are done. This will give us a large finished surface to "register" from in subsequent operations. Next I would finish two opposite edges parallel. It is obvious that these edges will be square with the flat sides if the "fixed" vise jaw has been trued with the ram as stated. The next finishing operation would consist in opening the vise jaws about $8\frac{1}{8}$ in. and placing the blocks in the vise, flat sides together, as many as the length of the vise jaws will hold conveniently. Care should be used to see that the previously finished edges are placed between the jaws for clamping. Since the blocks are 1 in. thick, twelve of them could be placed, flats together, in a vise having jaws 12 in. long. A strip of cardboard can be placed on the face of the moving jaw, before closing it, to insure secure clamping in case there is any variation in the width of the blocks and so that all the work will be rigidly held.

We are now registering the work from the fixed jaw and the resulting cut must necessarily be square with all the previous cuts made from the same jaw; "mechanically square" as your contributor suggests. I take that to mean as near to a perfect square as any good machine which is in perfect trim can perform. Of course, no ordinary shop machine tool could cut a perfect right angle, theoretically speaking, unless it might happen by chance; a chance very remote. The rest is easy, simply turn the blocks with their last rough side up, use the cardboard again for clamping and make the last finishing cut, registering again from the same fixed jaw. The method described will not only insure good accurate work, but will be economical production by finishing many blocks at one setting.

D. Q. DUNSTONE
Durham, England

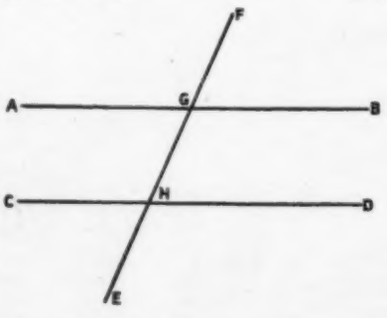
Perhaps the greatest difficulty met with while attempting to solve a problem of this description is to get a clear idea of all the factors. I understand that the shaper is in good condition, but I will not assume that the horizontal feed slide is straight and parallel enough to permit the machine to make parallel cuts for any position of the ram on the slide.

I would agree with the truing up of the solid jaw and the bottom between the jaws and if the loose jaw is not on a swivel, it too, should be machined.

All the die blocks should first be machined to size on two parallel sides. I would suggest that they be machined, one side in each setting, the die being in a vertical position in the vise.

In order to machine a third side, the fixed jaw of the vise must be set square to the path of the cutting tool. An approximate setting can be obtained by turning the vise through 90 deg. according to the graduations on the vise, which, I understand is on a swivel. The solution of the problem is based on the correction of this approximation.

The reasoning which leads to the solution I submit is geometrical.



The line AB is parallel to CD, EF is a straight line cutting AB at G and CD at H. Then angle FGB = angle FHD (known as corresponding angles, I believe). But angle FGB + angle BGE = 180 deg. (FE is a straight line). Substituting for angle FGB. Then angle FHD + angle BGE = 180 deg. ∴ When angle BGE = angle EGB = 90 deg., angle BGE = angle EGB = 90 deg. So that if we can machine the dies so that two opposite sides are parallel and two adjacent angles equal, adjacent sides will be square one with the other.

Place a block in the vise so that the machined sides

are gripped by the jaws and remove a cut from the third side.

The die should now be turned over in the vise so that the side which was in contact with the loose jaw comes in contact with the fixed jaw.

Run the tool along the third side again and test for parallelism by means of feeler gages.

Turn the vise on the swivel to reduce the reading of the feeler gage to one-half the original reading; i.e., if the machined surface is 0.003 in. out of the path of the tool, reduce this reading to 0.0015 in. by moving the vise.

The third side of the die should again be machined, turned over in the vise, and tested again for alignment with the path of the tool.

This procedure should be repeated, until the tool touches the die throughout the length of the side for each of the two positions of the die in the vise. The vise will now be set and should not be moved on its swivel, or on the table until all the dies are machined on the third side.

The vise may now be turned through 90 deg. and the fourth side machined to size and parallel to the third side by the method already employed in the machining of the first pair of parallel sides.

To test for square, be sure that opposite sides are parallel. Make a test square and scrape it to fit one pair of adjacent sides of the die. The fact that it fits the other three corners is proof that the four angles are equal and thus are each of 90 degrees.

•

F. H. MAYOH

Designing Engineer, Package Machinery Company

The operation of shaping die blocks so that they will be square when reversed with forms cut in their faces introduces interesting features and divides itself into two distinct problems.

The first question is, how to know that the ram of the shaper when traversing along the side of a piece of work is shaping at an exact right angle to the fixed jaw of a vise. The second problem is, how to handle the work so that it will be shaped square on all four

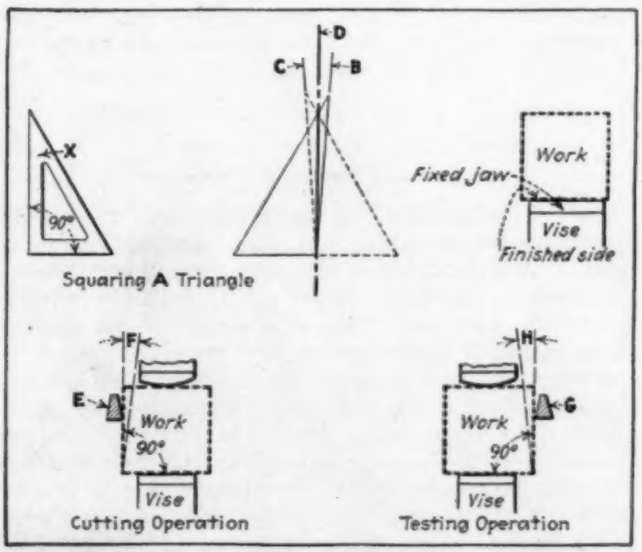


Fig. 9—Still another way of proving the vise is at right angle to the ram

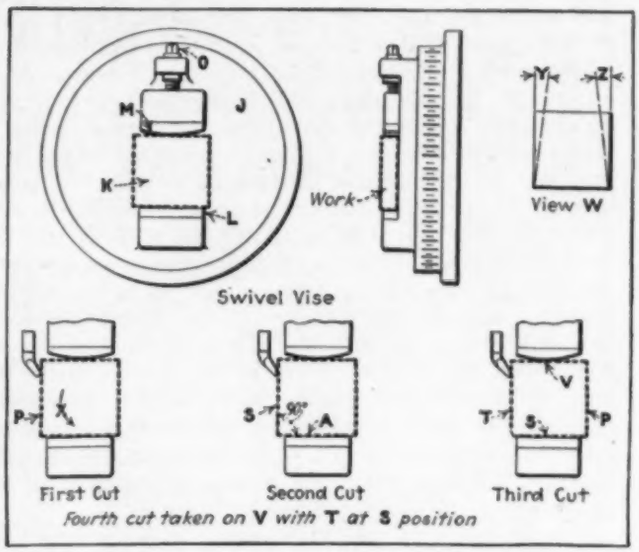


Fig. 10—Sequence of machining operations on die-blocks

sides. The second problem is entirely dependent upon the correct approach to the first, and to be sure the work is shaped at an exact right angle to the fixed jaw of the vise I would proceed as follows after first machining both sides of the die blocks to the correct thickness. To illustrate the reason for this; in the upper left-hand corner of Fig. 9 is shown how an experienced draftsman would true up a triangle so that the edges are at an exact 90-deg. or right angle. The triangle is indicated at *X* mereley for illustrative purposes and, assuming that the angles between the base line and the vertical line are not at exactly 90 deg. the draftsman would proceed to draw one line *B* with the lower edge of the triangle resting on a tee square. He then would turn the triangle over as shown by the dotted lines and in the same manner draw line *C* along the vertical line of the triangle. If the triangle is exactly 90 deg. the line drawn will be exactly perpendicular as shown at *D*, both times drawn, but if the triangle is not a true 90-deg. angle the inaccuracy will be doubled as indicated by the angular discrepancy between lines *B* and *C*. The same principle is employed to prove that the fixed jaw of the swivel vise on a shaper is at an exact right angle to the shaping line of the ram, as will be evident from the following description.

First, machine one side of the die block accurately (disregarding squareness) and place that side against the fixed jaw of the vise as shown in the top right-hand view in Fig. 9, this is a view looking down on the table of the machine. The vise used is shown in Fig. 10, at *J*, and is of the swivel type. The work is clamped against the fixed jaw *L* by tightening the movable jaw. The movable jaw has its clamping face curved as shown at *M* so that it bears on the unfinished side of the work at the center, thereby clamping triangularly and insuring that the finished side of the work will be held accurately against the fixed jaw of the vise. The operator then proceeds as shown in the lower left-hand view of Fig. 9, here the shaping tool is indicated at *E* and this machines the left-hand side of the work.

Assuming that there is a variation in the square from a 90-deg. angle as indicated by the angular lines *F*, this will be in evidence when the operator takes the next step which is to turn the work over and clamp it in the

vise with the bottom surface up and the finished surface still against the fixed vise jaw. The operator then moves the tool slide so that the tool is at the right-hand side of the work as indicated at *G*, if the machining is not at exactly 90 deg. the error will be double that indicated by the angle *H* and will show up in the same way that it shows up by drawing a line with a triangle, which is to say that if the operator introduces a piece of paper between the tool *G* and the work at each end of the ram travel and the paper can be drawn out with exactly the same tension he then knows that his vise is set correctly and that he can machine along a side at an exact right angle to the fixed jaw of the vise. An experienced operator would start the shaper and run the tool slowly up to the work and if it would cut at one end and not at the other he would know that the vise should be swiveled a little in the right direction to correct the inaccuracy following which he would turn the work over on the opposite side and repeat the testing operation until the tool would track exactly in the previous cut.

I have described this vise setting at some length as it is vital to the accuracy of machining squares. The final shaping cut before making the reversing test should be a very light one, as should be the finishing cuts which are taken while machining the sides of the die block.

Referring again to Fig. 10, the actual machining operations on the die blocks are performed as shown in the lower three views, with the finished side of the work clamped against the fixed jaw as previously described, and with the movable jaw clamping at the center of the work the first shaping cut is taken on the side *P*, being careful not to turn the work over. It is then rotated in the direction of the arrow *X* so that side *P* is clamped against the fixed jaw, following this, side *S* is shaped and as we have just proved that the shaping cut is at right angles to the fixed jaw we know that the angle between *P* and *S* is exactly 90 deg. Again rotating the work in the direction of the arrow *X* and without turning it over, side *S* is clamped against the fixed jaw and side *T* is shaped. The careful operator will then rotate the work until *T* comes against the fixed jaw and machine side *V*, after which he can feel certain that the block is square, provided all finishing cuts when taken have removed about the same amount of material.

A very decided objection to first machining one side of the work, then traversing the tool across to the opposite side and machining is that the stresses and twisting strains set-up in the tool holder and ram of the shaper in machining come from opposite sides of the work, and one cannot know what the deflection from a right angle would be in doing this, therefore it is conceivable that the work might be machined with a variation from square as indicated by the angles *Y* and *X* in view *W* of Fig. 10. By machining from one side at all times the deflection is always the same and in the same direction, in addition this deflection has been allowed for by the test made in setting the vise in the manner described in Fig. 9, as the trial cut was taken on the same side of the work as that it is taken on in the actual machining of the die blocks. In turning the block over to make the test, no machining is done, but the ram of the shaper is moved from end to end to test for squareness.

■

To protect containers for nitriding, paint them with a mixture of tin oxide and glycerine, inside and out.

SEEN AND HEARD

●

The Curse of Noise

ENGINEERS of one machine tool manufactory propose to take the noise out of high-speed production milling machines, under the theory that the constant clatter costs real money by reducing the efficiency of workmen. The Simonds company plans to eliminate or reduce to a minimum all noise in its new plant. Hiram Maxim announces a new silencer for office windows, and welding equipment manufacturers proclaim that another great value of their process is its silence. Other manufacturers are struggling with such words as acoustics, masking, tempering, and damping. In fact, the day may come when the shop is so quiet that visitors will be able to hear an old man chatter or a lathe dog bark.

Cost Systems—Old and New

"WOULDN'T I be a peach to send back into the shop?" said my machine-shop friend of the Nineties. "The first thing I'd do would be to change these modern cost systems. Cost systems! Pfooey, they're all right in theory, but the mechanic is no bookkeeper, and you can't expect him to wipe off his hands every couple of minutes, hunt up a stub of a pencil, and write on a time slip just what he's been doing during that time. No sirree! What does he do? He waits a half day or until quittin' time, then sits down with his pencil and starts in. 'Lessee,' says he, 'Four hours on that job for the erection shop, and two hours on that job for Jones—that dirty dog! By golly, he's gonna pay! Where's that eraser—Two hours for the erection shop, and four for Jones, an hour on S-7, Cleaning Machine, and two on S-9, General Labor. I didn't do any general labor or clean any machine, but where the hell did those other three hours go then?' And there you are—your clerks can sweat all they want to, and your cost man worry his fool head off, but it all goes back to the man in the shop, and he—well, he don't give a damn!"

—*T.*

Quick Clamping Fixtures

MANY INGENIOUS fixtures have been devised for holding work on milling and other machines, but in too many cases the designer has been content with locating and holding the piece properly. The time required to locate the work and clamp it is almost, if not quite, as long as that of the milling itself.

More recently, however, the handling time has been greatly reduced. Ingenious locating devices coupled with quick clamping arms operated by hand, air, or hydraulic means now handle work in much shorter time than ever before. Hydraulic clamping control seems to be growing in favor, supplanting air in many cases. All of which adds piping, valves, and other accessories, but also adds to productiveness in no small measure. —*J.R.G.*

Table for Estimating Sheet Metal Bends

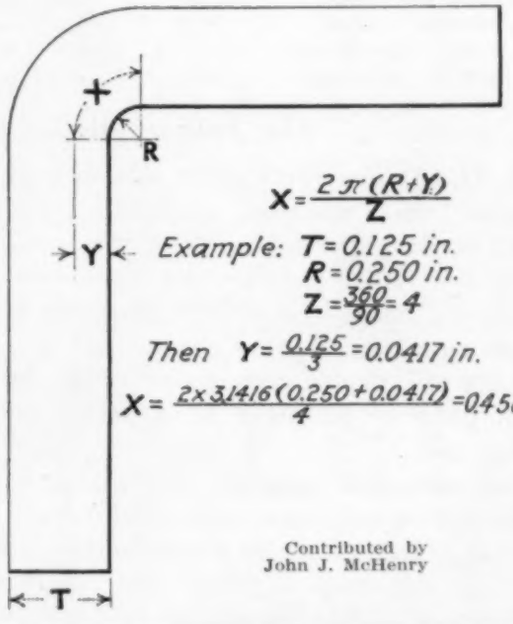
All Figures Given at 90° Bend

T	0.00R	0.005R	0.010R	$\frac{1}{64}$R	0.020R	$\frac{1}{32}$R	$\frac{3}{64}$R	$\frac{1}{16}$R	$\frac{3}{32}$R	$\frac{1}{8}$R	$\frac{3}{16}$R	$\frac{1}{4}$R	$\frac{5}{16}$R	$\frac{3}{8}$R
0.010	0.005	0.013	0.021	0.030	0.037	0.054	0.079	0.103	0.152	0.202	0.300	0.398	0.496	0.594
0.015	0.008	0.016	0.024	0.032	0.039	0.057	0.081	0.106	0.155	0.204	0.302	0.401	0.499	0.597
0.020	0.011	0.018	0.026	0.035	0.042	0.059	0.084	0.109	0.158	0.207	0.305	0.403	0.501	0.599
0.025	0.013	0.021	0.029	0.038	0.044	0.062	0.087	0.111	0.160	0.209	0.308	0.406	0.504	0.602
1/32	0.016	0.024	0.032	0.041	0.048	0.065	0.090	0.115	0.164	0.213	0.311	0.409	0.507	0.605
0.040	0.021	0.029	0.037	0.045	0.052	0.070	0.095	0.119	0.168	0.217	0.315	0.413	0.512	0.610
0.050	0.026	0.034	0.042	0.051	0.057	0.075	0.100	0.124	0.173	0.223	0.321	0.419	0.517	0.615
1/16	0.033	0.041	0.048	0.057	0.064	0.082	0.106	0.131	0.180	0.229	0.327	0.425	0.524	0.622
0.083	0.044	0.051	0.059	0.068	0.075	0.093	0.117	0.142	0.191	0.240	0.338	0.436	0.534	0.632
3/32	0.050	0.057	0.065	0.074	0.080	0.098	0.122	0.147	0.196	0.245	0.343	0.442	0.540	0.638
1/8	0.066	0.073	0.081	0.090	0.097	0.115	0.139	0.164	0.213	0.262	0.360	0.458	0.556	0.654
5/32	0.082	0.090	0.098	0.106	0.113	0.131	0.155	0.180	0.229	0.278	0.376	0.475	0.573	0.671
0.166	0.087	0.095	0.103	0.111	0.118	0.136	0.161	0.185	0.234	0.284	0.382	0.480	0.578	0.676
3/16	0.098	0.106	0.114	0.122	0.129	0.147	0.172	0.196	0.245	0295	0393	0.491	0.589	0687

THE formula here given, together with the table calculated from it, is in general use in die shops for calculating 90-deg. bends in sheet metal. It assumes one-third of the stock thickness outward from the bend as the neutral plane. As set up here, the formula may be used for bends of any angle.

For average work, it is correct, but if the part to be formed must be accurate within a few thousandths, the formula is only a point from which to start; the part must be developed on the actual tools. The method used is of course governed by the individual problem encountered. Different types of bending, forming, and curling tools, even though producing the same finished part, may use different sizes of blanks, depending entirely upon the method of forming. For example, a hinge with the curled end U'd up in one operation and folded over in another will take a shorter blank than will the same hinge if the curled end is formed in one operation by a cam die driving the curl all from one end.

In the table, T is stock thickness and R is radius of bend. In the formula, X is length of stock required for the bend, Y is one-third the stock thickness, and Z is a factor obtained as follows: The angle of the bend desired is divided into 360 deg. The result is Z. For example, Z for 90 deg. is 4.



$$X = \frac{2\pi(R+Y)}{Z}$$

Example: $T = 0.125$ in.
$R = 0.250$ in.
$Z = \frac{360}{90} = 4$

Then $Y = \frac{0.125}{3} = 0.0417$ in.

$$X = \frac{2 \times 3.1416 (0.250 + 0.0417)}{4} = 0.458 \text{ in.}$$

Contributed by
John J. McHenry

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New Things in Store

THE OLD YEAR becomes history and not very good history at that. Perhaps in the long view of the historian, one will find that 1930 was salutary; at present one can conclude only that 1930 was an unbeautiful exhibition of human stupidity. Try as it might, industry was stalemated by forces and inertias largely outside its control.

But the New Year is another thing. Its very newness gives promise of better things. Machine tool and equipment builders are on the whole prepared for the renewed advance of business. As will be shown three weeks hence in the Semi-Annual *American Machinist* Shop Equipment Review, more new devices have been brought out than in any previous six-month period.

Other new things are here for the asking—new things in architecture, in chemistry, in electricity, in various lines. All provide wider scope and broader markets for the metal-working industry. It is, therefore, timely to announce that a large part of the forthcoming issue will be devoted to some of the new things in store.

The Tale of Ali Bagha

IT IS TOLD that there dwelt side by side in Bagdad two machine merchants, known through the length and breadth of the land for their wealth. Allah smiled, many machines were sold, and the money bags of both merchants grew greater day by day, both in number and in size. But while Ali Bagha grew to hoard his gold, Hassan gave of his store to what he called "development."

There came then upon the land a time when men wanted not machines, when Allah turned his face away from men, a time known in that fabled day as a "depression." Then was Ali Bagha sore dismayed, and he hoarded his gold the more, tarrying within his house for "better business." But Hassan, scorning the voices of the wise men, grew each day more lavish, giving yet more dinars to "development." And the unbelievers laughed, prices fell, and his friends shunned him as a fool.

But again there came a time when Allah smiled, and men quoth, each to the other, "We must have machines that are new; ours are old, they profit us nothing!" Then fared they forth to Ali Bagha saying, "Show us machines." And Ali Bagha replied, "Here are machines of which you know much, machines such as have served the faithful faithfully for many years gone." "But," queried they, "Have ye none other newer?" "None," laughed Ali Bagha, "Would you that I were like Hassan the Foolish?" Then from his shop came the voice of Hassan, "You called me foolish and reviled me, but here have I machines the like of which no man hath seen, that will do all you ask, that will cost no more but profit you much!"

Then did all men turn their backs on Ali Bagha——

Back to the Simple Life

"BIGGER and better," whether expressed in sales or manufacturing, affects machine tool building just as it affects all other industries. The result is more capable, more powerful, more costly machines year by year. These may be exactly what the production executive desires, but what of the "little fellow," small in himself but in the aggregate a great market? Have not the efforts to produce "bigger and better" tools left him sadly neglected? His actions would lead one to believe that he feels that way.

Schools, hotels, garages, repair shops—all seem to be hungry for light-duty, versatile equipment capable of handling a general range of work, yet available at a modest price. This is not idle talk; one machine tool builder sold fifty-six hundred light units of a single type last year, principally to schools and service shops. Though the price of one unit is below five hundred dollars, the total is over two million—a right respectable business. Single sales of this sort require no unusual marketing or distribution efforts, for any reputable hardware store can be an agent. Another builder has awakened to the possibilities and will soon follow suit. How soon will others prepare to meet the demand?

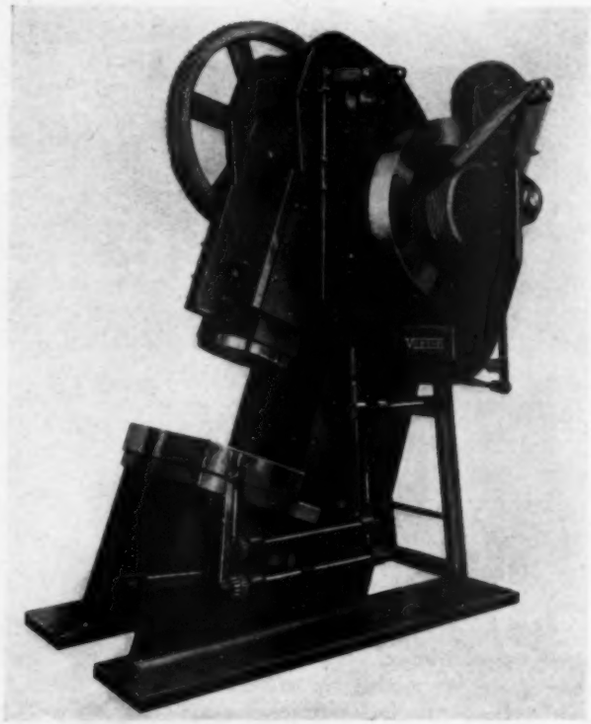
SHOP EQUIPMENT NEWS

"Verson" All-Steel, Overhanging-Type Permanently Inclined Press

All-steel, fabricated construction is employed for the "Verson" overhanging-type, permanently inclined press, developed by the La Salle Machine Works, Inc., 3013 South La Salle St., Chicago, Ill. It is an addition to the line of "Verson" straight side and inclinable presses constructed of rolled steel plates cut to size and shape by the acetylene torch and arc welded into units. Ribs and supports are so placed as to afford great rigidity. For example, when this press was tested with a 50 per cent overload, the frame showed no appreciable amount of deflection, and no "labor" was apparent in any of the working parts.

The machine illustrated is of 250 tons capacity, and has an 8½-in. crankshaft, 10-in. stroke and 14 in. depth of throat. The frame, ram, and gears are all of welded steel plate construction. The main bearings are bronze bushed and the gibs are of steel with bronze linings. Roller bearings support the backshaft, the flywheel, and the flywheel support. Annular ball bearings are applied in the pinion support. The roller-bearing, multiple-disk friction clutch is equipped with an automatic safety stop designed to disengage the clutch at the top of the stroke. An auxiliary hand lever device is provided to disengage the clutch instantly at any point of the stroke. This feature is of importance for safety and die-setting purposes.

Unusual quietness of operation is a feature of this press. The flywheel revolves on an extra long Timken roller bearing and is the only moving part when the clutch is disengaged. The herringbone backgear and pinion are offered as standard equipment and also add to the silence of operation, while providing better drive. The gibs and gibways are unusually long and the top of the ram is never out of the ways. Motor Texrope drive is supplied. Lubrication is effected through a one-shot grease system.



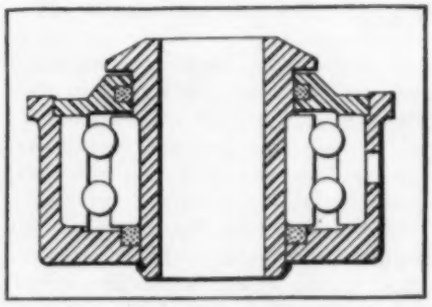
"Verson" All-Steel, Overhanging-Type, Permanently Inclined Press having a capacity of 250 tons and a 10-in. stroke. The weight of this model is 30,000 lb.

"National" Rotating Jig-Bushing

A rotating jig-bushing has been placed on the market by The National Boring Tool Company, Detroit, Mich. It can be employed with boring-bars utilizing tungsten-carbide, and because of the close fit prevents vibration. It is claimed that the "push-fit" is just right for such tools, since no rotation takes place except in the thrust ball bearing.

The "National" rotating jig-bushing also has found use in exact reaming processes, where jig-bushing clearance must be avoided. In fact, by its use semi-finishing operations have been eliminated in some instances. It has also found use in line-reaming fixtures, and also as a bushing in core-drilling jigs, where the revolving bushings prevent wearing off the land on the drills.

"National" Rotating Jig-Bushing, which is of value in accurate boring operations with tungsten-carbide, in line-reaming fixtures, and in core-drilling



Sectional drawing of "National" Rotating Jig-Bushing

Hisey-Wolf Model M Texdrive Buffer

Open-type spindle extensions are now available on the Model M Texdrive buffer for the 3-, 5- and 7½-hp. sizes manufactured by the Hisey-

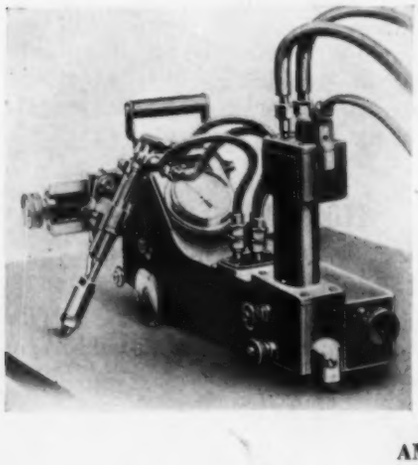
Hisey-Wolf Model M Texdrive Buffer having open-type spindle extensions to permit easy handling of odd-shaped pieces

Wolf Machine Company, Cincinnati, Ohio. The spindle and buffing wheels extend out from the base of the machine, permitting easy handling of large or odd-shaped pieces. The motor mounting is of the external type with a rigid four-point support. Texrope drive for the motor in the base is also employed. The motor is ball bearing equipped and has dovetailed sliding base including gib with necessary locking screws.

Distance between the inner spindle nut and the housing is 12 in. on both sides, in all cases, while the overall length is 48 in.

"Messer" Portable Oxyacetylene Cutting Machine

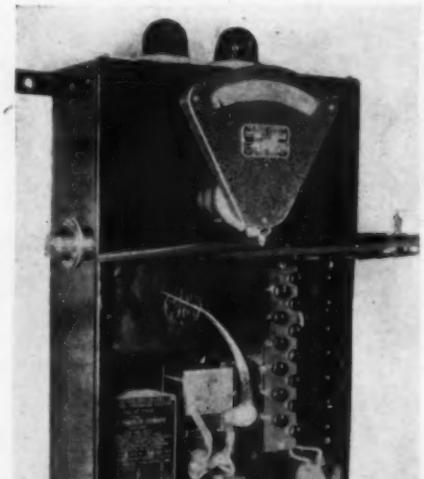
The latest importation of Jos. C. Paulus & Company, 2507 Potter St., Philadelphia, Pa., is a portable oxyacetylene cutting machine with a built-in universal motor of 1/60 hp.



This machine can be equipped with a manometer for registering the gas pressure for different thicknesses of metal, and thus allows even an inexperienced operator to get an even travel and a clean and even cut. The mixing chamber is placed back of the cutting nozzle to allow the gases to expand and unite before they are ignited, thus obtaining a neutral flame. Cutting nozzles are made of two parts fastened separately into the cutting head, one inside the other, producing a round ring preheating flame with the cutting oxygen passing through the center of the flame. The preheating nozzle can be unscrewed for cleaning when necessary, while the cutting nozzle can be cleaned in place or removed as desired.

Maehler Temperature and Safety Control for Industrial Ovens

One of the difficulties experienced in the operation of industrial ovens for baking, japanning and drying operations is to secure positive temperature control and provide uniform

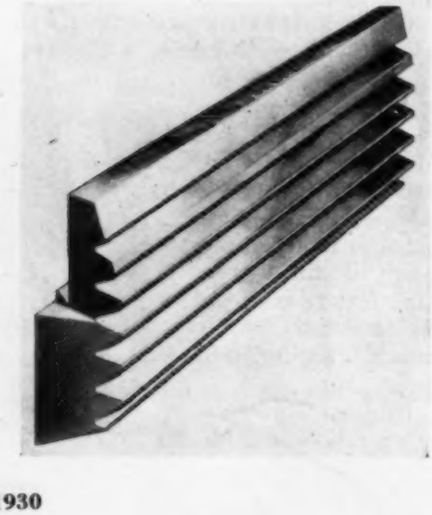


baking conditions at all times. A completely automatic control in one unit to perform these functions has been placed on the market by the Paul Maehler Company, 2208 West Lake St., Chicago, Ill. It is known as the Maehler electrical control unit, the cabinet measuring 20x16x5 in., and utilizing a raised lid which may be locked with a key to prevent tampering. It may be installed at any convenient place adjacent to the heating equipment, such as the Maehler universal heater.

In the cabinet are assembled the various devices providing automatic control, such as the main switch, fuses, temperature-control valve, automatic mercury actuator, a gas-pressure controller, high-voltage transformer, time daily control, and green and red flasher lights to indicate the condition of operation. The cabinet is energized by a 110-volt line through a snap switch on the outside. Attached to the outside is the indicating controller, which may be set for any temperature desired. Adjustable arms provide the maximum and minimum range, and control the fuel supply. On the heater itself is located a Maehler-Maxon automatic shut-off safety valve, which in event of either fan or fuel failure, automatically shuts off the fuel supply.

Landis Ground-Thread Chasers

Ground-thread chasers have been developed by the Landis Machine Company, Waynesboro, Pa., for use in all sizes of the "Lanco" and "Landex" heads and for the $\frac{5}{8}$, $\frac{7}{8}$, $1\frac{1}{4}$ and 2 in. "Landmatic" heads. The thread form is ground to remove minor inaccuracies and distortions resulting from heat-treatment and to produce a flat crest and root. The ground thread form offers greater accuracy and also freer cutting action.



Cincinnati "Hypro" Openside Planer

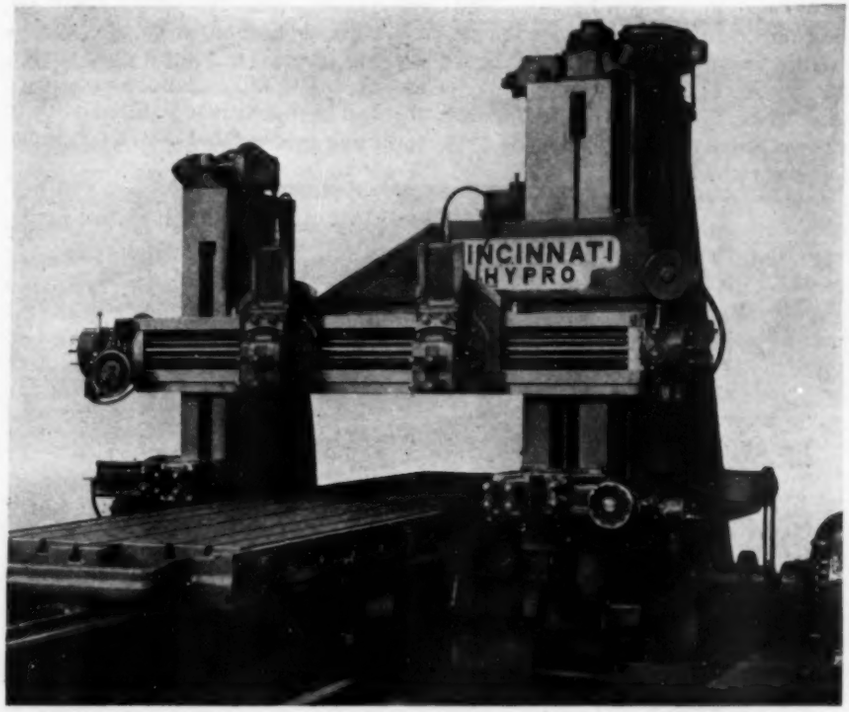
Several improvements have been made in the "Hypro" openside planer manufactured by The Cincinnati Planer Company, Cincinnati, Ohio. When using tungsten-carbide tools, it is essential that the tool clear the work on the return stroke. A pneumatic tool lifter has been attached to each head for this purpose, and is without any projecting parts or lugs that might interfere with work in close quarters. All moving parts are made from hardened and ground steel to afford long life. This tool lifter can be used simultaneously on all heads or on any head desired.

Coolant is supplied to the tools, and the return is worked out in such fashion as not to interfere with the regular working surface of the table. The coolant drains to the left side of the table and thence through a short pipe to a steel trough on the left side. This trough in turn drains into a tank at the rear of the left housing, where the small pump and motor are mounted.

Push-button control is now provided for all motions. On the openside the rail and knee are clamped to the column through an electric clamp operated by a torque motor. A push button at each end of the rail clamps and unclamps the rail, and another push button operates the raising and lowering of the rail and the rapid traversing of the rail and side heads.

The left-hand housing is an auxiliary type to permit the use of a fourth head. The entire housing and the head can be removed in a few minutes when a wider piece of work than the table will accommodate is to be machined. No changing of any connection is required when the housing is removed. This housing carries a separate small motor for rapid traversing the fourth head.

A shifting device is provided as special equipment to give short strokes varying from 1½ to 2 in., depending on the type of reversing motor employed. This is of advantage particularly when machining in close quarters inside of a casting. The handwheel at the left-hand end of the rail is part of the built-in indexing device for use in rack cutting and spacing. Small dogs are placed on the table between the regular shifter dogs for speeding up the table on gaps between parts to be planed. The small belted unit on the side of the column is an electric speedometer constantly registering the speed of table travel for both cut and return, by means of a dial at the control panel.



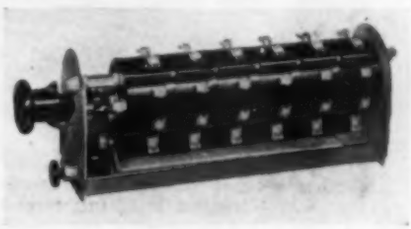
Cincinnati "Hypro" Openside Planer, which is now fitted with a pneumatic tool lifter and is completely operated through push-button controls. The left-hand auxiliary housing is removable without changing any connection

Jones & Lamson Model 21 Tangent Die—*Correction*

In the original description of this die on page 411, Vol. 73, no mention was made of the fact that the chasers are ground in the thread, a most important feature. These chasers are held tangent to the work rather than radial, as is the more common practice. They are accurate in shape, spacing and helix angle, and are so spaced in the die relative to one another that perfect tracking is obtained. The dovetail on the back of each chaser is also ground, and ratchet teeth are cut in the tongue of the dovetail to engage mating teeth in the chaser holder. Chasers are sharpened by removing from the end an amount equal to the pitch of the teeth on the back.

General Electric Switches for Changeable-Pole Motors

Two switches for use with multi-speed, changeable-pole motors have been announced by the General Electric Company, Schenectady, N. Y. These switches bear the designations CR-2960-SY-108 and SY-113, having maximum capacities of 5 hp. and 10 hp. These switches, when used



with multi-speed, squirrel-cage, induction motors, permit obtaining different speeds by changing the polar grouping of the stator coils.

For small motors one of these switches will serve as a starting switch, as well as a pole-changing switch. Both switches can be used with two-, three- or four-speed motors for constant-horsepower or constant-torque service without change in mechanical construction.

In operation the speed point is selected by turning the knob handle to the desired position. Depressing the knob completes the main circuits and then picks up the magnetic line switch through the momentary disk contacts. The holding interlock is then closed and the switch latched in this position. Pressing the "stop" button trips the holding interlock, dropping out the magnetic switch, and then opening the main contacts. Undervoltage protection is thus provided between speed points.

Société Genevoise Type PF-2A Precision Screw-Cutting Lathe

The smallest screw-cutting lathe manufactured by the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, known as the type PF-2A, has been redesigned and is now being offered by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. This lathe now has a bored spindle, permitting the use of spring collets and the machining of long thin pieces, as well as working the larger pieces on a revolving center. It is also provided with a slotted faceplate permitting internal threading.

Change gear wheels are employed for obtaining different pitches. By means of a set of wheels furnished with the lathe, it is possible to obtain 36 pitches in inch units between 4.5 and 100 threads per inch as well as 37 metric pitches from 0.1 mm. to 5.0 mm. Accuracy of the threads obtained is guaranteed to 0.0001 in. for the whole length of the range of the machine, that is 8 inches. Maximum distance between centers of this lathe is $8\frac{5}{8}$ in. and external threads up to 2 in. in diameter can be cut. The maximum diameter of a workpiece over the ways is $6\frac{11}{16}$ in., and over the carriage, $4\frac{3}{4}$ in.

As shown by Fig. 2, the leadscrew is compensated automatically for any small errors by the use of an arm extending from the nut to a curved slot, the curvature of which is determined from accurate measurements of the errors of the screw. Slight additional rotation or retardation of the nut at any point serves to hold the cutting tool at all times in the correct position for the standard temperature of 68 deg. F. The plate carrying this slot can also be rotated about an axis to make correction for temperature so as to cut screws to be standard at any temperature between 32 and 68 deg. F.

The slotted faceplate furnished is $4\frac{3}{4}$ in. in diameter and allows threading of pieces up to $3\frac{3}{16}$ in. external diameter. The lathe is driven through a 4-pulley countershaft and a $\frac{5}{16}$-in. round belt to the driving pulleys, giving the four work speeds of 26, 46, 78 and 140 r.p.m. The return speeds are three times the above.

The toolholder is adjustable in two directions, at right angles, by means of two micrometer screws reading to 0.0004 in. To disengage the cutting tool at the end of the cut, the upper slide can be pulled back rapidly by a lever and then returned to its previous working position without varying the adjustment of the micrometer screw that determines the depth of cut. This speeds up work and avoids useless wear of the micrometer screws. The tailstock is also adjustable. The headstock is fitted with a reversing gearing and clutch coupling.

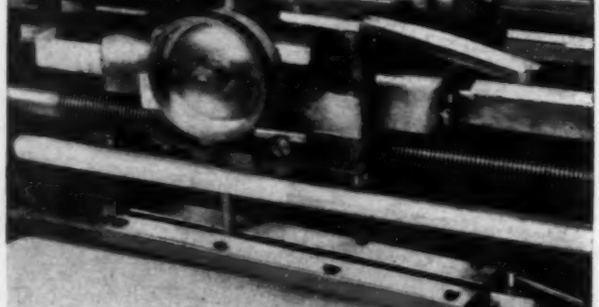


Fig. 2—Device for compensating errors in the leadscrew of the Société Genevoise Type PF-2A Precision Screw Cutting Lathe

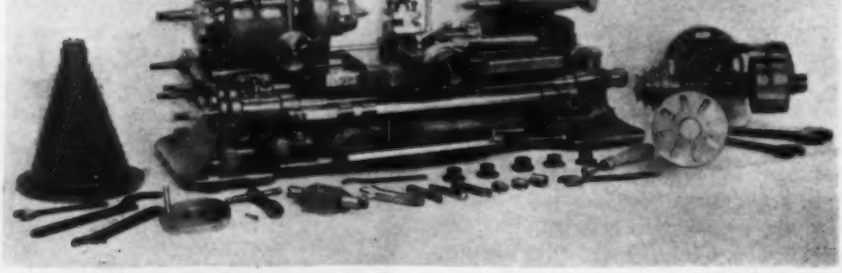


Fig. 1—Société Genevoise Precision Screw Cutting Lathe for cutting 36 pitches between 4.5 and 100 threads per in. Maximum distance between centers is $8\frac{5}{8}$ in.; largest external thread cut, 2 in.

Spring collets of an external diameter of $\frac{9}{16}$ in. are supplied in sizes varying by 0.02 in. from 0.02 in. to 0.5 in., or special collets can be supplied. The driving plate for external threading is 4 in. in diameter. Other equipment includes a toolholder for internal threading, a bored draw-in bar, a set of female centers, a magnifying lens with support, and two sharpened cutting tools of 60 and 55 deg. angle.

The overall length is $31\frac{1}{2}$ in., the width $15\frac{1}{8}$ in., and the height $13\frac{3}{16}$ in., the height of the spindle over the bottom of the bed being $9\frac{5}{8}$ in.

Olsen-Lundgren Special, Semi-Automatic Electric-Spark Dynamic Balancing Machine

The ease with which an 8-cylinder crankshaft can be balanced to within 0.05 oz.-in. illustrates the sensitiveness and accuracy of the special Olsen-Lundgren semi-automatic, electric-spark, dynamic balancing machine. This model was exhibited at the Power Show by the Tinius Olsen Testing Machine Company, 500 North 12th St., Philadelphia, Pa.

Many differences in construction are evident between this balancing machine and the previous machine described on p. 877, Vol. 70. The new machine has great sensitivity, neat appearance, fast testing ability, and is very convenient in operation. The older model, however, is not superseded by the present offering, since there are many classes of work to which it is peculiarly adapted.

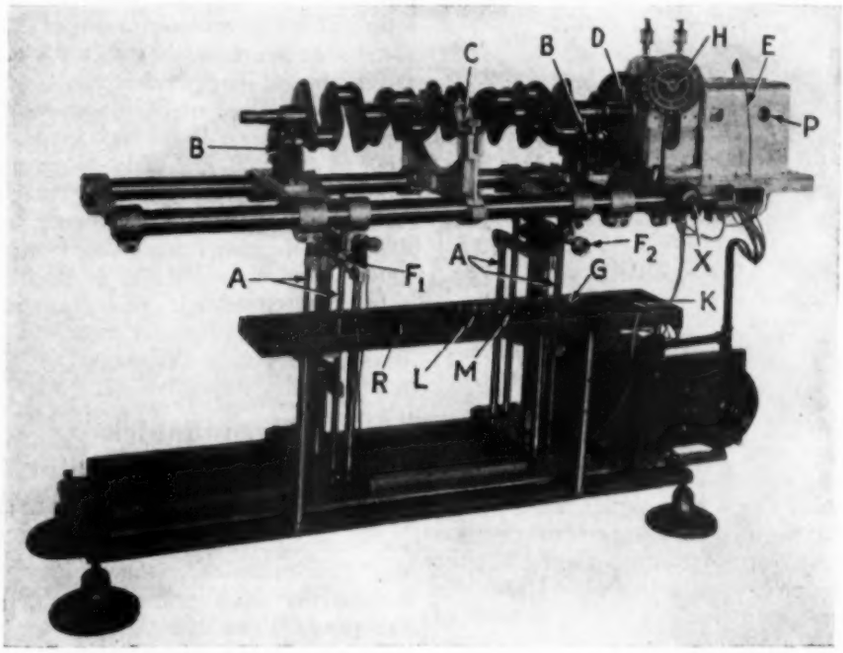
Dynamic balancing machines of the type to be described are available in five sizes for other work. Capacities are as follows: No. 2—10 to 50 lb.; No. 3—30 to 175 lb.; No. 4—150 to 750 lb.; No. 5—500 to 2,500 lb., and No. 6—2,000 to 10,000 lb.

Referring to the illustration, the machine consists essentially of a vibrating frame carried on flexible members *A* slidably mounted on the base. The vibrating frame comprises two horizontal shafts, the roller brackets *B*, the center steadyrest *C* for preventing excessive whip of long crankshafts, the driving means *D*, and the mechanism comprising the phase-angle shifter in the cabinet *E*. As many parts of the vibrating frame as practicable are made of aluminum to reduce the inertia effect. This vibrating frame may be locked at F_1 or F_2 to obtain the amount of unbalance at either end of the crankshaft.

After a crankshaft is placed on the rollers and connection is made at the driving head, it may be locked at F_1 and the amount of unbalance at F_2 obtained. Rotation of the crankshaft at 250 r.p.m. is caused by throwing the switch *X*. Then, by turning on a switch *G*, the sparking apparatus *H* comes into play, showing the angular position of unbalance in the shaft at the end F_2. The operator observes the mean of the angle of sparking arc. Switch *G* is then thrown off and switch *K* is thrown on, which shows the angular position of the compensating weight in housing *E*. Pressing the "forward" and "retard" buttons at *L* changes the angular position of the compensating weight with respect to the part being balanced. When the point of sparking for the compensating weight is brought around to the original sparking point, the compensating weight arm lies in the same plane as the plane of unbalance of the part being tested. Switch *K* is then thrown off and switch *G* is thrown on again, causing sparks on dial *H*. By depressing the buttons *M*, alternately as necessary, a known weight in the weight holder is moved in and out radially to the drive shaft axis. The previous operation having located and compensated for the plane of unbalance, this operation compensates for the amount of unbalance. When this weight is properly adjusted, the sparking ceases on dial *H*. The weight-holder tube scale has a range of 20 oz.-in., and by means of a large vernier, the unbalance can be read to 0.05 oz.-in. in the No. 3 size machine displayed.

By turning the machine by hand until the axis of the compensating weight coincides with the hairline in the window at *P*, the part being balanced is brought to a position where the heavy side at the end being tested is toward the front of the machine and in a horizontal plane through the axis of the part. Having determined the amount and angular position of unbalance, the size and depth of drilling or other means of correction may be quickly determined by use of a suitable chart.

To obtain the unbalance at the other end of the crankshaft, it is locked at F_2 and switch *R* is used instead of switch *G*.



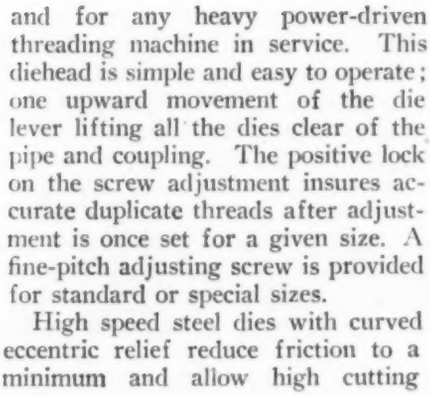
Olsen-Lundgren Special, Semi-Automatic, Electric-Spark, Dynamic Balancing Machine with an 8-cylinder crankshaft in position and the steadyrest closed

"Bikeko" Pipe-Threading Diehead

Dieheads known by the trade name of "Bikeko" can now be furnished by the Bignall & Keeler Machine Works of the N. O. Nelson Manufacturing Company, Edwardsville, Ill., on new Peerless and PDQC machines

and for any heavy power-driven threading machine in service. This diehead is simple and easy to operate; one upward movement of the die lever lifting all the dies clear of the pipe and coupling. The positive lock on the screw adjustment insures accurate duplicate threads after adjustment is once set for a given size. A fine-pitch adjusting screw is provided for standard or special sizes.

High speed steel dies with curved eccentric relief reduce friction to a minimum and allow high cutting



One upward movement of the lever lifts all the dies on the "Bikeko" Diehead clear of the pipe and coupling

speeds. These dies have the cutting edge well ahead of the center line. The die block is made in two sections, the upper section holding the die and provided with screw adjustment for increasing or reducing the clearance on each side. Die slides have long travel, allowing one set of dies to handle all sizes within the capacity of the head, so long as the taper and thread remain the same. One die can be replaced without renewing the entire set.

In changing from one size to another, it is necessary only to remove one screw and re-insert in the proper hole for the next size. Additional adjustment is obtained with the fine-pitch adjusting screw.

Spencer-Turnbull Universal Angle Vise Plate

The "Connecticut" universal angle vise plate described on p. 448, Vol. 69, of *American Machinist* is now known as the "Spencer-Turnbull" universal angle vise plate and is manufactured by the Spencer-Turnbull Company, 278 Main St., Hartford, Conn. The design is the same, but two sizes have been added to the line. The four sizes now manufactured are: No. 1, base $2\frac{3}{8}$ in. x $4\frac{1}{2}$ in., table 2 in. in diameter, height $2\frac{3}{4}$ in.; No. 2, base $4\frac{1}{2}$ in. x $7\frac{1}{2}$ in., table $3\frac{1}{4}$ in. in diameter x $4\frac{1}{2}$ in. high; No. 3, base $6\frac{1}{2}$ in. x 9 in., table $4\frac{1}{2}$ in. in diameter x $5\frac{13}{16}$ in. high, and No. 4, base $6\frac{3}{4}$ in. x 12 in., table diameter, 6 in., and height, 7 in. The T-slots in the four sizes are $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$ and $\frac{3}{8}$ in., respectively.

Wyr-omat-ick Clearance Compensator

Constant clearance in bearings is maintained automatically by means of the "Wyr-omat-ick" compensator announced by the Wyrick Engineering Company, Wyandotte, Mich. If excess clearance is permitted between parts having lateral movement under more or less force, the resultant pounding tends to increase such clearance, rendering the latter rapidly accelerative. By taking up such play, this compensator avoids the accelerative action and prolongs the useful life of the bearing and of reciprocating parts. In fact, a burnishing action takes place in bearings, with the result that the bearings become highly polished and the friction is reduced. Necessity of machining to close limits is eliminated, and lighter bearings may be employed.

The major parts are two mating helical cam-faced members, Figs. 1 and 2, which when placed together, as shown in Fig. 3, will increase or decrease their joint cross-sectional dimension if rotated in opposite directions. These two members serve the space-filling requirements which are necessary as wear occurs. The power spring, illustrated in Fig. 1, which is attached to both cams when assembled, provides the power to rotate the cammed members whenever this action is required.

The expanders, illustrated in Fig. 1, are two hardened steel balls with expansion springs in back urging them outward to exert a pressure against the inner surface of the slotted cam when the cams are placed face to face as shown in Fig. 3. This action in-

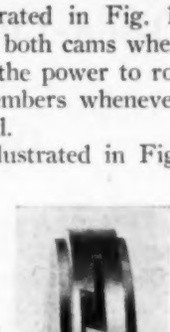


Fig. 3—Case removed from compensator to show the relation of the control pin with the control ribs

Fig. 1—Smooth cam of the "Wyr-omat-ick" Compensator

Fig. 2—The slotted cam, showing the integral control ribs

sures separation of the two cam-faces as through wear increased space occurs.

The T-shaped control pin is ground to project beyond the face of the smooth cam, in which it is assembled, a distance equal to the maximum clearance required. Thus, when the cams are placed as shown in Fig. 3, the control pin projects into one of the slots of the slotted cam and engages one of the ribs of the latter, insuring against any rotational action between the two cams unless sufficient space is allowed to permit the cam-faces to separate a distance equal to the protruding portion of the control pin.

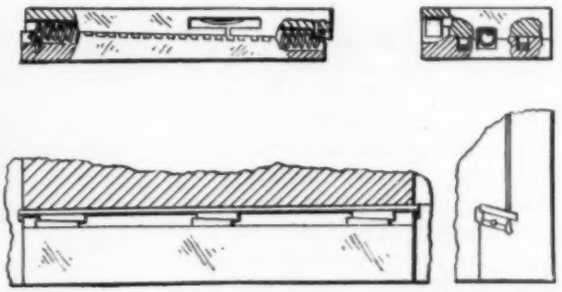


Fig. 4—"Wyr-omat-ick" Compensator for gibbed ways and other sliding bearings

The control ribs of the slotted cam are spaced to insure the desired dimension of readjustment required at each adjustment period. For example, if the total cam rise equals 0.062 in. and it is desired to readjust at each 0.001 in. increment of wear, then 31 ribs would be milled (equally spaced) on one-half of the cam-face; thus the thickness of the cam would be 0.001 in. greater at each rib up the cam surface. These increments can be made to suit individual requirements, and the total number of ribs also.

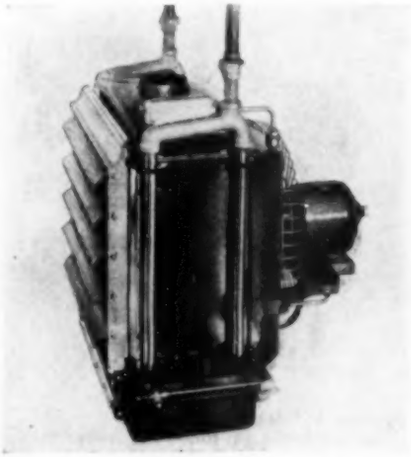
The compensator is further provided with a locking seal. This seal holds the cams in their reduced dimension relation until the compensator is properly assembled in working position between two spaced parts, after which it is removed. Then the compensator acts merely as a precision spacing washer, readjusting action taking place only at intervals when, through wear or other factors, the combined clearances of the assembly reach the predetermined maximum.

The various members co-act in the following manner: Inserted between two spaced parts with the compensator reduced to minimum dimensions, the power spring urges opposite rotation of the two cammed members, and such rotational action is restrained by a control rib obstructing passage of the control pin; the expanders continually urge separation of the cam-faces and as wear takes place and space is provided the cams gradually separate until the control pin has clearance to pass the obstructing rib. Then the power spring enforces opposite rotation of the cams and this action increases the joint dimension of the cammed members, closing the space between the cam-faces, thereby compensating for the increased clearance. The control pin is again obstructed from passing the next rib in the series, and the compensator unit again acts as a mere spacing washer until further wear permits another readjustment cycle. Any maximum or minimum limits of clearance may be maintained automatically, until the maximum capacity of the compensator has been reached.

All compensators are made special. Shaft sizes built so far range from $\frac{1}{2}$ to 6 in.

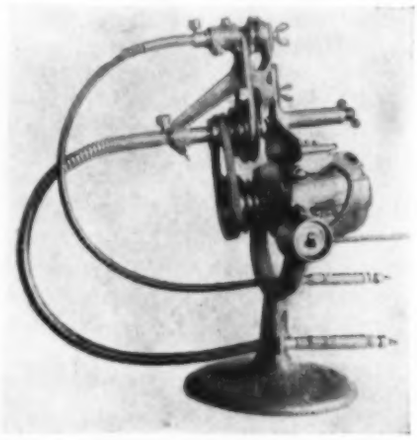
Humphrey No. 200 Unit Gas Heater

Either manufactured or natural gas can be burned in the Humphrey No. 200 unit gas heater announced by the General Gas Light Company, Kalamazoo, Mich. It has an input rating of 200,000 B.t.u. per hour. When equipped with a six-blade fan, propelled by $\frac{1}{4}$-hp. 1,140 r.p.m. motor, the unit will deliver 2,600 cu.ft. of air per minute with a 50-deg. temperature rise over room temperature. It is 83 per cent efficient when vented, and is equivalent to about 700 sq.ft. of steam radiation. The unit is finished in black and green japan with nickel trim. Over-all dimensions are $32\frac{1}{2}$ in. high, $28\frac{1}{4}$ in. wide, and $31\frac{1}{4}$ in. deep. The shipping weight is 520 lb. The unit may be operated by either remote or thermostatic control.



Keller Two-Shaft, Flexible-Shaft Machine

Shafts for low- and high-speed use respectively are embodied in the two-shaft flexible shaft machine announced by the Keller Mechanical Engineering Corporation, Brooklyn, N. Y. The first shaft is for ordinary work employing tools with $\frac{1}{16}$- to $\frac{1}{4}$-in. shanks running at four speeds, ranging from 875 to 3,500 r.p.m. The second shaft, which is the upper and lighter shaft, is for high-speed work with a speed range of 5,250 to 10,500 r.p.m. The latter shaft is particularly suitable for finishing and polishing dies, utilizing small, formed abrasive stones down to $\frac{1}{8}$ in. in diameter. The light shaft assembly may be attached to any Keller-Flex machine with four-speed pulleys, thereby doubling its usefulness. High-speed drive can be added by simply changing the overarm for one that carries a small pulley mounted on ball bearings.



Since the work to be performed

with the high-speed shaft is of a delicate nature, a light, and more flexible shaft is employed. To release the strain on the shaft, slots are milled on the motor bracket so the whole unit may be moved until the balance point is found.

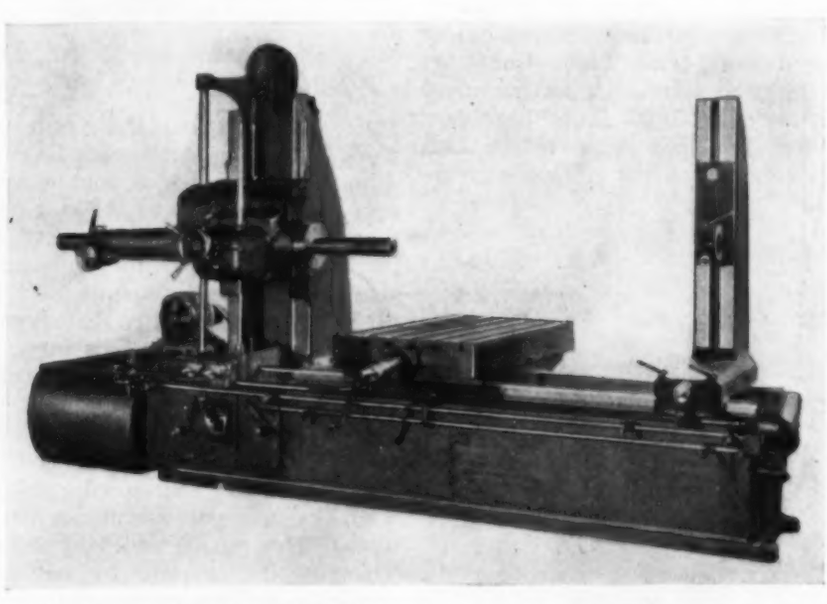
To accommodate small grinding stones, a smaller hand piece has been developed, having no play in the spindle because of the self-adjusting ball bearings. The outside diameter is $\frac{3}{4}$ in., so that the tool may be held in the fingers for very fine work.

The larger shaft may be left on the machine for coarser work. The small shaft may also be used on jack-shaft pulley, so that small burs and rasps may be used at the slower speeds varying from 875 to 3,500 r.p.m. By means of interchangeable spring collets, burs or grinding stones may be used with shaft diameters varying from $\frac{1}{16}$ to $\frac{3}{16}$ in.

Lambert Horizontal Boring Machine

A 4-in. boring bar with a travel of 30 in. is employed on the horizontal boring machine illustrated. This machine, manufactured by the Lambert Machine Tool Company, Bucyrus, Ohio, has a maximum distance from the faceplate to the outer support bearing of 84 in. The head has a vertical power feeding movement of 30 in., and the cross and longitudinal power feeding movements of the table are 40 and 60 in. A range of 24 feeds is available, varying from 0.004 to 0.250 in. per revolution of the boring bar. This machine is thus adapted for cutting right-handed or left-handed threads in various pitches beginning with 4 threads per inch.

Either motor or belt drive may be employed without alterations in the machine. The bar may be rotated at speeds varying from 7 to 216 r.p.m. in either direction. A multiple-disk clutch running in oil is placed between the motor and the transmission. Remote control is provided so that the operator can start, stop, or reverse either the boring bar or any of the feeding movements from every part of the machine. A $7\frac{1}{2}$-hp. motor is required and the weight of the machine is 16,000 lb.



Lambert Horizontal Boring Machine, having a 4-in. bar with a travel of 30 in., and a maximum distance from the faceplate to the outer support bearing of 84 in.

DeWalt All-Steel Fabricated Bandsaw

Built completely by electric welding, the DeWalt fabricated bandsaw is light in weight and of sturdy construction to eliminate vibration and to increase the service life of the blade. This bandsaw is manufactured in two types: a two-wheel unit, and a three-wheel unit. The 16-in. machine has two wheels, whereas the 24- and 30-in. models are equipped with three wheels. All models employ $16\frac{1}{2}$-in. aluminum wheels, balanced and mounted on Timken bearings, with an adjusted tracking device. They are built by De Walt Products Corporation, Lancaster, Pa.

DeWalt Fabricated Bandsaw, which because of the great rigidity increases the service life of the saw blade

The use of the three pulley wheels makes possible greater throat clearance. Minimum hazard of operation is obtained by efficient guarding. The bandsaw track and the wheels are contained in one frame. Motors of $\frac{1}{2}$, $\frac{3}{4}$, or 1 hp., with V-type pulley and belt, are furnished.

Shepard-Niles "Compact" Hoist and Model 21 Trolley

Two developments were marketed recently by the Shepard Niles Electric Crane & Hoist Corporation, 388 Schuyler Ave., Montour Falls, N. Y. The first is a "Compact Hoist," Fig. 1, which embodies sectionalized construction and uses interchangeable parts. By the use of the same body piece and attaching different motor and gear end sections, varying requirements of speed or capacity can be met. The motors are especially designed to meet the requirements of hoisting service and are of the 30 min., 50 deg. C. rating. All moving parts in the gear end operate in an

oil bath, and all gears are of steel, heat-treated. The load block is fully enclosed, except on the close-clearance type of hoist. An improved electric brake and limit switch are now embodied. Ball bearing trolley wheels for the push-type trolley afford ease in operation along a runway beam. Balanced drive through the use of planetary gearing maintains positive alignment and greatly reduces bearing pressures.

To meet the demand for light-capacity hoists to be propelled along their runways by motor-driven trolleys, the model 21 trolley, illustrated in Fig. 2, has been developed. This illustration shows a "Compact Hoist" and a model 21 trolley completely assembled.

Fig. 1—Shepard-Niles "Compact Hoist," which is of sectionalized design to permit assembling different motor and gear end sections to meet speed or capacity requirements

Among the important design features of the trolley are: All steel construction; ball bearings throughout; grease lubrication; motor mounted directly underneath trolley sides and rotates about the center line; trolley capable of negotiating small radii down to 3 ft. 0 in. minimum and through narrow-throw switches; guide rolls to prevent skewing of trolley; trolley designed to operate on standard I-beams and certain sizes of I-beams with Shepard Track; and load carried from top of yoke.

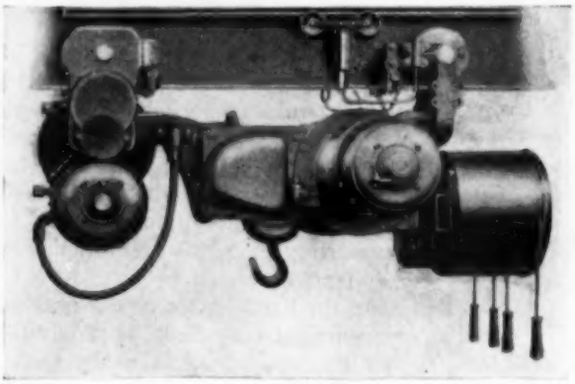


Fig. 2—Shepard-Niles "Compact Hoist" and Model 21 Trolley assembled in a unit

Townsend Second-Operation Forming and Drilling Machines

Two second-operation machines equipped somewhat differently have just been developed by the H. P. Townsend Manufacturing Company, Hartford, Conn. The first, illustrated in Fig. 1, is a combination drilling and forming machine, and is particularly suited for handling all kinds of previously formed blanks and operations on small tubes and shells, and also secondary operations on screw-machine products. This type is capable of pointing, forming, shaving, drilling, and hollow milling. The drilling mechanism can be used in conjunction with a forming operation or independently for drilling hollow rivets. It is equipped with a feed which will feed blanks either end into the chuck.

Headless blanks and small tubes or shells can be fed automatically from the hopper up to certain limits of length. A magazine feed can be applied for handling such work as cannot be fed from the hopper. These machines are built in three sizes to handle from the smallest work up to $\frac{5}{8}$ in. in diameter by 5 in. long. The largest drill carried in the drilling attachment is $\frac{1}{4}$ in. Speed of production depends on the amount of metal to be removed and the permissible cutting speed. A No. 1 machine will operate as fast as 100 pieces per minute and the No. 2 machine, 80 pieces per minute. All types of machines in each size are built on the same frame, use the same feeds and the same spindles, and are so similar that

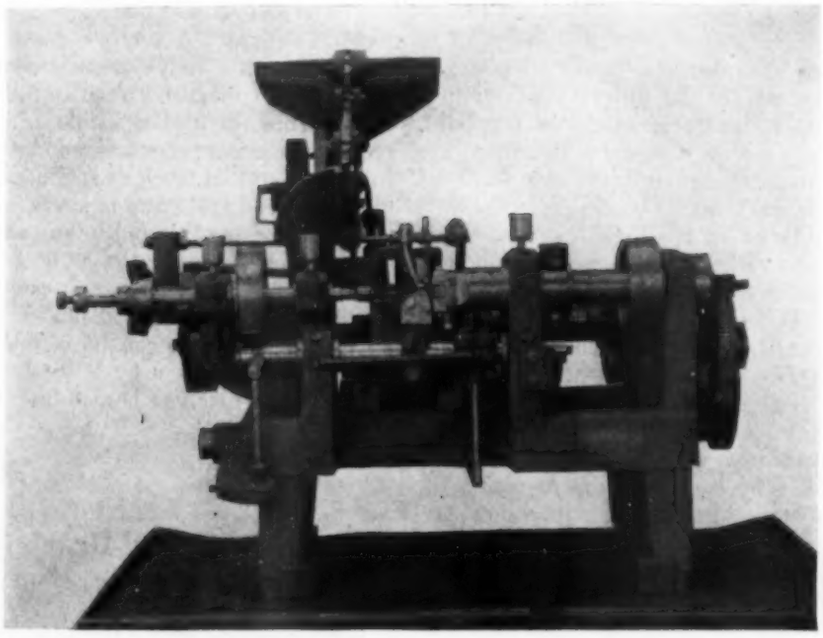


Fig. 1—Townsend Combination Drilling and Forming Machine for handling previously formed blanks, operations on small tubes and shells, and secondary operations on screw-machine products

Fig. 2—Townsend Double-End Drilling Machine arranged for drilling cotter pin holes crossways in clevis pins

one operator can easily operate any one of the 20 different adaptations for which these machines are built. All the adjustments provided are easily accessible from the front of the machines. The design lends itself to being set up singly, or in batteries, for overhead belt drive or individual motor drive.

The second machine, illustrated in Fig. 2, is a double-end drilling type set up for drilling cotter pin holes crossways through clevis pins and bolt blanks. It is equipped with a track, or magazine feed, which is filled by hand, thereby requiring the operator to visit the machines frequently for feeding and inspection of the drills and the work, as the small drills employed must be kept sharp to insure clean holes and to avoid breakage. Both drills start drilling simultaneously from opposite sides. When they reach the center, one drill is withdrawn and the other continues on to finish the hole. This overcomes heavy burrs and gives a greatly increased production over a single drill going all the way through from one side.

It will be evident that the left end of this machine is the same as the type illustrated in Fig. 1. The right side is equipped with a drill spindle installed in place of the chuck spindle, the work being clamped in the backrest fixture. When fairly large drills are used, or the drilling of brass is encountered, the drills will operate for a long time without getting dull, and consequently the machine can be equipped with a fully automatic hopper feed. A magazine feed can also be furnished for feeding blanks which require centering preparatory to being turned or ground, such as small spindles, taps, end mills, and reamers. In this case, the work is fed in line with the spindles.

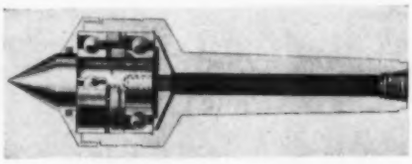
For cotter pin holes, work can be handled up to $\frac{7}{16}$ in. in diameter by $3\frac{1}{2}$ in. long. Work can be centered up to 1 in. diameter by 9 in. long. This type of machine is also built in three sizes.

Sturdimatic Ball-Bearing Live Center

Compensating means for the extra thrust imposed by work heating up during machining are embodied in the ball-bearing live center announced by the Sturdimatic Tool Company, 12121 Cardoni Ave., Detroit, Mich. This is effected by the use of two steel cushioning rings between the two ball bearings. Minimum overhang assures rigidity of the tool during operation.

The housing has a removable threaded plug at the tapered end. This plug is removed and replaced by an Alemite fitting for lubrication. For extremely heavy work a quill-type center is made to fit in the tailstock.

Seven sizes of the ball-bearing live center are available, with Morse tapers varying from Nos. 2 to 7. Radial and thrust capacities at 100 r.p.m. range from 1,410 to 25,875 lb.



Sturdimatic Ball-Bearing Live Center, which is built to permit the use of tungsten carbide to capacity

"Economy" Ball-Bearing Tiering Machines

Both hand- and power-operated, plain and telescoping tiering machines have been placed on the market by the Economy Engineering Company, 2653 West Van Buren St., Chicago, Ill. Ball bearings are used throughout the gearing, in the sheave, and in the platform frame wheels. On the "Telescopers" sliding frame wheels are also so equipped. Friction is further reduced through recently designed flangeless guide wheels for supporting the platform and telescoping frames.

In the hand-power type a cranking pressure of only 25 lb. is required to lift the rated load. In the electric models, the greater efficiency resulting from the use of ball bearings has

been employed to provide faster travel of the platform.

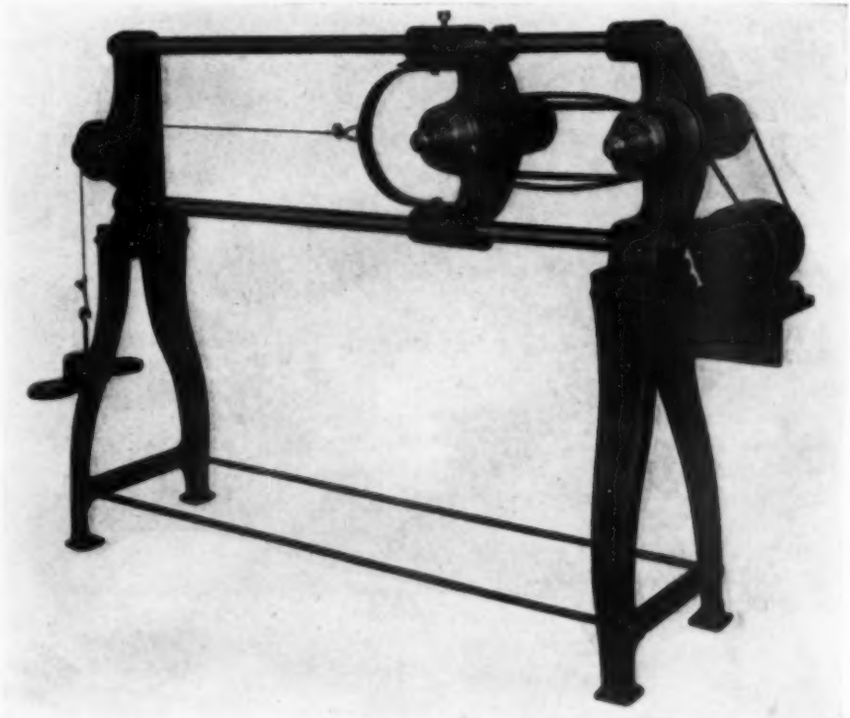
Spur-geared hoisting units are used exclusively. Electric machines are equipped with high-torque motors of ½, 1, 2 and 3 hp., depending on the speed of operation required. All are controlled alike, unless otherwise specified, by means of a single lever drum switch. Automatic limit stops prevent overtravel of the platform. An Alemite lubricating system is employed for the guide, sheave, and base wheels, as well as on the hand power hoisting unit. Both types are finished in aluminum with red and black trimmings so that they are easily visible and readily located in large plants or dimly lighted warehouses.

Norman Endurance Testing Machine for Belts

Destruction tests of V-belts can be made in 100 hours on the Norman endurance testing machine built by the Tinius Olsen Testing Machine Company, 500 No 12th St., Philadelphia, Pa. Two belts are run in parallel. Each shaft carries two pulleys of slightly different diameters. If the smaller pulley on one shaft is toward the front of the machine, the smaller pulley on the other shaft is toward the rear. No power is taken off the driven shaft, but one of the belts tends to drive the shaft a little faster than does the other. In consequence, one belt acts as a brake on the other. As shown in the illustration, the rear belt pulls with the top strand, and the front belt with the bottom strand. The slip is determined by the diameter ratio of the pulleys.

Tension in the belts is produced by dead weights pulling on the sliding cross-head which carries the driven shaft. Because one side of each belt is slack, the tension difference in each belt is very nearly equal to half the total tension produced by the dead weights. The machine, then, consumes only power necessary to cover the belt losses.

Besides V-belts, the machine is suitable for testing flat belts. By arranging the tests to approximate the conditions of operation in a plant, the belt purchaser can determine which brand will give the most satisfactory service.



Norman Endurance Testing Machine for belts, which is employed for testing to destruction in a comparatively short period

Wodack Electric Dual Twist and Hammer Drill

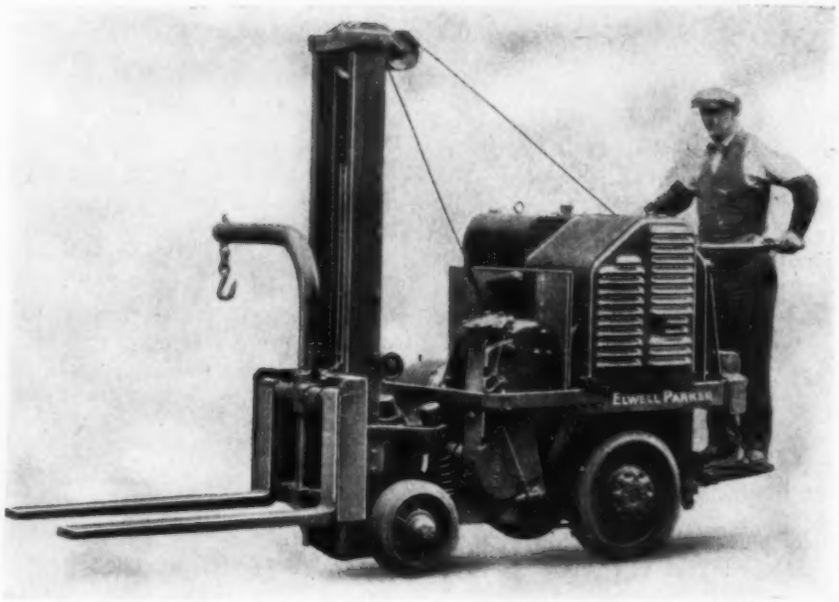
Drilling up to ⅜-in. holes in metal, ½-in. holes in wood, and ⅞-in. holes in stone can be accomplished with the electric dual twist and hammer drill announced by the Wodack Electric Tool Corporation, 4627 West Huron St., Chicago, Ill. It is also suitable for grinding, scratching, or buffing. The tool itself weighs only 12 lb., and

the entire kit only 20 lb. It is furnished in a metal carrying case with star drills and twist drills. Grinding, scratching, and buffing wheels, and a bench stand can be furnished, as well as a convenient stand for use as an auxiliary drill press or bench grinder.

Elwell-Parker Electric Lift and Skid Tiering Truck

Hand lift trucks are designed with such small wheels that the skids they handle are too low or lack sufficient clearance to permit the use of electric lift trucks, because of the size of the tires and bearings provided on the larger machines. Consequently, the electric lift truck illustrated employs two heavy steel forks for getting under skids. It is manufactured by the Elwell-Parker Electric Company, Cleveland, Ohio.

It is particularly suitable for picking up loaded skids and tiering them three skids high. A swivel boom with a capacity of 2,000 lb. is built in to provide means for swinging a heavy piece into the machine or to carry it suspended from place to place. The boom is swung out of the way when the skids are being handled and is turned 90 deg. for service. When the boom is in use, the two hinged forks are swung upward and rest in an inclined position back toward the operator and out of the way. Another feature of this machine is that the



Elwell-Parker Electric Lift and Skid Tiering Truck for tiering skids three high or lifting heavy pieces with the swivel boom

uprights may be tilted forward 8 deg. or backward 35 deg. All control mechanism is immediately before the operator, and it is necessary for him to dismount only when changing from the fork to the boom operation.

Improved Ditto Machine

An improved Ditto machine, suitable for reproducing specifications, contracts, drawings and sketches, has been placed on the market by Ditto, Inc., Harrison and Oakley Blvd., Chicago, Ill., Detailed drawings can be reproduced neatly at a cost of five to ten cents per hundred. Forms needed only in small quantities can also be produced, where printing would be too expensive.

The original record may be a drawing, a hand written memorandum, or typewritten or printed sheet. In all cases a special Ditto ink, pencil, or typewriter ribbon must be used. The machine makes copies by transferring ink, which may be had in colors, direct from the original to a duplicating composition, which dissolves and holds the ink on its surface. This copying surface is mounted on a cloth backing, 14½ ft. long, which can be rolled upon two rolls. Within a few hours the duplicating composition absorbs the impression and can be used again.

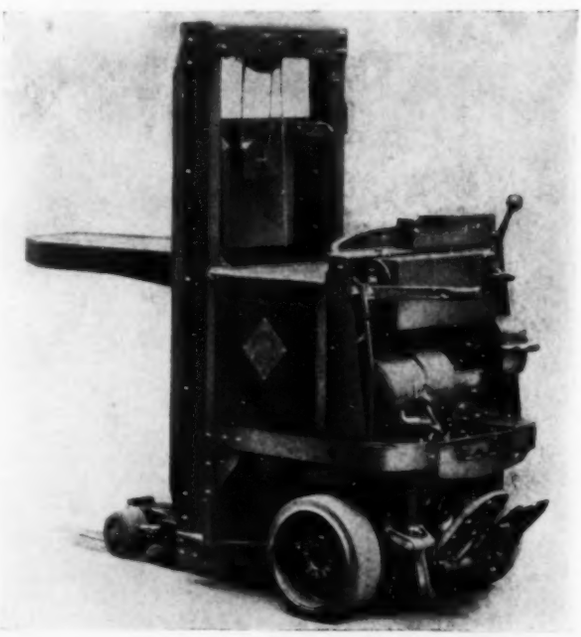
The main features of the machine are the two side frames supporting a flat steel bed over which travels a feeding carriage, which lays down the blank sheet and picks up the copy. One spindle on which the roll is wound is fastened in the rear, and the other spindle is placed in front. Several improvements have been incorporated in the present machine.

The machine is made in four standard sizes: C, K, L and M, with street capacities from 8½x14 to 22x34 in. Special sizes are also available.

Elwell-Parker Tiering Truck

Capacity of 3,000 lb. is found in the tiering truck recently placed on the market by the Elwell-Parker Electric Company, Cleveland, Ohio. It is 29 in. in width and therefore is suited to narrow aisles in the average shop. The 18x7-in. high platform will lift a 24 to 30 in. x 48 in. skid or container to a height of 63 in. Over-all height is 83 in., sufficient to get through 7-ft. doorways or box-car entrances. The operator or his helper may ride the platform to the upper level to place the goods in stock bins.

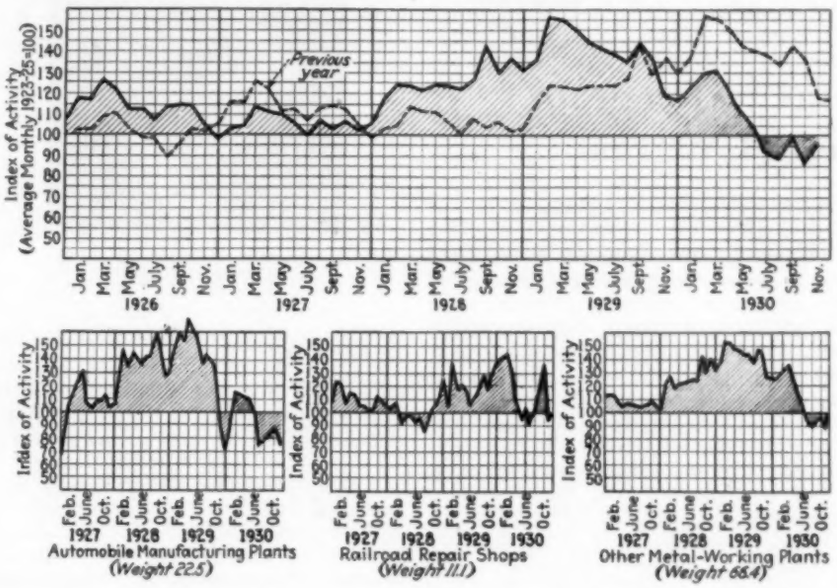
The same safety features as found in the larger sizes manufactured are also employed in this small model. Lifting is effected by a worm-gear speed reduction to cables that elevate the cantilever platform. All four wheels are steered by means of automobile-type ball and socket levers. The truck may be fitted with battery or gas-electric drive. It offers possibilities in older plants at congested points that larger and heavier trucks could not approach.



NEWS OF THE WEEK

Industrial Production Index Shows Rise in November

GENERAL metal-working activity rose from 86.4 in October to 95.7 in November, according to latest reports received on the consumption of electrical energy for power purposes. Reports are corrected for 26 working days. Though September operations showed a decided upturn from those of the previous month, the October decline more than equalled the previous advance. The present advance is almost as sharp as the previous drop.



The railroad shop index for November, adjusted for 26 working days, was 97.8. This compares with 96.0 for October and 136.1 for September. Ferrous and non-ferrous metal-working plants, outside of automobile and repair shops and railroad repair shops, had a November final index of 99.4, as compared with an October figure of 87, and a September final index of 97.4. The November final figure for automobile manufacturing plants is 74.9, as compared with 80.9 in October and 88.4 in September. Automobile manufacturing plants are the only ones showing a continued decline in activity.

The downward trend starting in January and continuing through July showed signs of a definite arrest in August after reaching the lowest point since October, 1924. All preliminary figures for September showed definite advances except that for the automobile manufacturing plants, but the October figures threw the indexes below previous low points of the year. The November figures, showing upturns in all cases but one, illustrate the increasing optimism of industry as the new year approaches, although the usual decline in activity is expected in December.

Seasonal adjustments revise the figures slightly. The November final figure for railroad repair shops, adjusted for seasonal variation, is 92.9, as compared with 97.4 for October and 140.7 for September. The metal-working index, similarly adjusted, declined from 98.7 in September to 88.8 in October, but rose to 104.0 in November. The automobile manufacturing index declined from 85.1 to 78.0 in October and rose to 88.3 in November. The general metal-working index, therefore, seasonally adjusted is 99.2, as compared with 87.3 for October and 100.4 for September.

An increase of 34.1 per cent is indicated in the total value of motor vehicles and trailers shipped by American factories in 1929, as compared with 1927, according to latest reports of the census of manufactures. In addition, the value of parts and accessories, reported by these establishments increased 30.5 per cent in 1929 over 1927. A number of passenger cars shipped increased 54.3, and the value increased 28.4 per cent. Total number of public conveyances shipped increased 199.0 per cent, while commercial vehicles increased 83.0 per cent in number and 69.8 per cent in value. There was an 8.3 per cent decline in the number of establishments reporting.

Continuing the decline which has characterized shipments to and from this country since the latter part of 1929, the value of United States foreign trade for November dropped well below that for the preceding month and broke through the upward trend begun last August, according to figures made public by the Department of Commerce. The total for imports and exports in November was $493,700,000, as compared with $574,493,000 the month previous. Exports totaled $289,000,000 and imports $204,700,000, bringing the latter item to the lowest point since October, 1921.

National Auto Show In New York on Jan. 3

With the coming of the 31st National Automobile Show in Grand Central Palace, New York, N. Y., on Jan. 3, motordom is far more optimistic than might be supposed. There are several logical reasons, including the one that by conservative estimate more than three million replacements will have to be made during the coming year in passenger cars and motor trucks. A variety of new designs in automobiles will be included in the show, among them a new 16-cylinder automobile and a new "midget" type. Though basic fundamentals of design exhibit less change than ever before, practically every factory has newly designed models. Standardization of construction and stability of design are being reached. Sixes will be in the minority and many new 8-cylinder models will be offered. Steel bodies are being used almost exclusively and shatter-proof glass is appearing in even the lowest priced cars. Another change is a much wider use of wire wheels and the wholesale removal of spare tires from the back of body to wells in the fenders. Oil cooling is also being used, one manufacturer causing the lubricating oil to circulate through part of the radiator as a means of increasing oil life, another building an oil radiator into the lubricating system, and still others using special rib cases on the crankcase to keep down oil temperatures. This is just one element in the changes to refined car lubrication.

SIMPLIFIED Practice Recommendation No. 57 on Wrought Iron and Wrought Steel Pipes, Valves and Fittings has been reaffirmed without change for a period of one year. A survey prior to the revision meeting indicated the degree of adherence to the recommendation to be approximately 98 per cent.

Chrome-Nickel Steel Symbols Standardized

Fifty-one steel producers have agreed to standardize specification symbols for chrome-nickel steel produced within agreed analysis ranges. The action was accomplished by mutual concessions and unanimous agreement on the part of those companies producing chrome-nickel steels under license by the Krupp Nirosta Co., New York. The new symbols are as follows:

STANDARDIZED SYMBOLS FOR NIROSTA, DESIGNATING TYPE OF STEEL WITHIN CLASSIFYING RANGES

BASE SYMBOLS:
KA2 for austenitic chrome-nickel alloys in the corrosion-resistant field.
KNC for austenitic chrome-nickel alloys in the heat-resistant field.

For Wrought Material:

	C Per Cent	*Mn* Per Cent	*S & P* Per Cent	*Si* Per Cent	*Cr* Per Cent	*Ni* Per Cent	*Mo* Per Cent
KA2.....	0.16 max.	0.6 max.	0.03 max.	0.75 max.	16.5–20.0	7–10.5	...
KA2-S.....	0.07 max.	0.6 max.	0.03 max.	0.75 max.	16.5–20.0	7–10.5	...
KA2-H.....	over0.16	0.6 max.	0.03 max.	0.75 max.	16.5–20.0	7–10.5	...
KA2-Mo.....	0.16 max.	0.6 max.	0.03 max.	0.75 max.	18–22	7–10.5	2–4
KA2-SMo.....	0.7 max.	0.6 max.	0.03 max.	0.75 max	18–22	7–10.5	2–4
KA2-HMo.....	over0.16	0.6 max.	0.03 max.	0.75 max.	18–22	7–10.5	2–4

The same symbols are used for cast material where Silicon max. limit is higher.

For Wrought and Cast Material:

KNC-3.....	0.20 max.	0.7 max.	0.03 max	2.0 max.	23–27	17–21	...

Announce Additions to Program For Western Metal Congress

MORE speakers have been added to the programs for the Western National Metal Congress and Western National Metal and Machinery Exposition, now taking shape in San Francisco. The double event will be held Feb. 16 to 30 in the Civic auditorium there. J. H. Knapp of the J. H. Knapp Co., Los Angeles, will speak on "Gas Furnaces for Nitriding," before the meeting of the Pacific Coast Gas Association which will be held in conjunction with the show. R. G. Guthrie will speak on "Carburizing Steel by Gas." Latest discoveries in nitriding will be outlined on the program of the A.S.M.E. during the show by O. E. Harder of the Battelle Institute, while P. G. McVetty, of Westinghouse, will discuss the creep of metals at elevated temperatures. A. H. d'Arcambal, of Pratt & Whitney, will speak on "Machinability of Metals."

F. N. Speller, National Tube Co., will give a review of corrosion findings, as ascertained during the past year, before the meeting of the American Chemical Society. On the same program, a speaker from the Merco-Nordstrom Valve Co. is scheduled to talk on corrosion and lubrication of valves. Chromium and chrome-nickel steels are to be discussed by M. A. Grossman, Republic Steel Corporation.

Two full sessions have been assigned the American Welding Society, although dates for all sessions are yet to be set. Programs devoted to welding will include J. C. Hodge, Babcock & Wilcox Co., whose subject is fusion welding. The Linde Air Products Co. is planning to assign a metallurgist to talk on carburizing flame and acetylene welding. Coated electrodes and coated welding rods will be the topic of A. B. Stroebel, Stoody Co.; while M. C. Smith, also of Stoody, will talk on welding of alloy overlays. Welding of aluminum and its alloys is to be the topic of W. N. Dunlap, Aluminum Research Laboratories, Aluminum Co. of America.

Plans for the Congress have been made on a scale of registering 5,000 delegates and interested persons, while 60,000 men, identified with the industrial end of the metal industry, are expected at the Exposition. Two years ago, the Congress and Exhibition was held in Los Angeles. W. H. Eisenman, Secretary of the A.S.S.T., is in charge of the program. Included in the societies participating are the American Chemical Society, A.I.E.E., A.I.M.E., A.S.M.E., A.S.S.T., A.W.S., Institute of Metals, National Purchasing Agents Association, Pacific Coast Electrical Association, Pacific Coast Gas Association, S.A.E., A.S.T.M., and the National Association of Power Engineers. A number of prominent metal-working executives are included in the personnel of the various committees.

Amtorg Adds To Purchases

The Amtorg Trading Corporation, New York City, American purchasing agent for Soviet industry, has purchased agricultural equipment and spare parts to a total value of nearly $3,000,000. This equipment will be shipped, together with tractors and combines worth $40,000,000, in the near future. The Automotive Department of the Amtorg made an additional purchase of 800 Ford trucks and 200 Ford passenger cars, knocked down. Nearly $300,000 worth of Hercules engines and transmissions for trucks have also been purchased. About $250,000 worth of additional equipment for the fertilizer plant of the Soviet Apatite Trust has been ordered. Other equipment is that for the foundry and assembling shops of the tractor plant now under construction at Kharkov, in Ukraine, and sheet metal presses for the Amo automobile plant in Moscow.

Bancroft Gherardi Elected President A.S.A.

Bancroft Gherardi, Vice-President and Chief Engineer of the American Telephone & Telegraph Co., has been elected president of the American Standards Association. Mr. Gherardi, who had been a member of the Association's Board of Directors, has been affiliated with the American Telephone

BANCROFT GHERARDI

& Telegraph Co., since 1907, and has been vice-president and chief engineer since 1920. He is past president of the American Institute of Electrical Engineers, and has also served as president of the United Engineering Society.

Cloyd M. Chapman, Engineering Specialist of New York City, was re-elected to the vice-presidency of the Association for the year 1931. Mr. Chapman entered the employ of Thomas A. Edison in 1899 as assistant in his private laboratory on experimental work. He has been engineer for Westinghouse, Church, Kerr & Co., in charge of design and construction work and as engineer of tests. His work has included the design and construction of a number of important central stations and industrial plants.

Cloyd M. Chapman will be chairman, and John C. Parker, Vice-president of engineering of the Brooklyn Edison Co., will be vice-chairman, of the A.S.A. Standards Council.

CLOYD CHAPMAN

PERSONALS

E. D. Bailey, President of the Fuller-Lehigh Co., has been elected a vice-president of the Babcock & Wilcox Co.

W. C. Buchanan, for the past year assistant to the president of the Keystone Steel & Wire Co., Peoria, Ill., last week was appointed vice-president and assistant general manager. Mr. Buchanan, prior to his association with Keystone, was identified with the Trumbull Steel Co., Warren, Ohio, and in his work in the investment and financial field had been prominent in mergers affecting Empire and Mid-States Steel.

Earl J. Card has resigned as assistant general manager of the Jamestown (N. Y.) Metal Equipment Co., to become general manager of the Olean (N. Y.) Metal Cabinet Works, Inc., to succeed the late R. G. Bullock.

Chester L. Erickson, formerly assistant to the general superintendent of the Walworth Co., Boston, has been appointed superintendent of production. J. E. Hart, formerly general superintendent, is now works manager.

At the annual meeting of stockholders of the Martin-Parry Corporation, York, Pa., F. M. Small, President, was elected chairman of the board to succeed John J. Watson, resigned, and W. A. Keysworth, W. C. Beitzel, J. E. Small and V. K. Keesey, all of York, Pa., were elected directors. Membership of the board was reduced to five from eight.

J. Frank Dorney, formerly supervisor, rating and methods division, Walworth Co., Boston, has been appointed assistant to the works manager. Mr. Dorney first became associated with Walworth in 1923.

J. Gilmore Fletcher, Managing Director of the Horace E. Dodge Boat & Plane Corporation, has resigned, and will be succeeded by Kenneth M. Smith, director of sales. Mr. Smith, in addition to active management of the company, will continue to direct sales from the New York headquarters. The directorate now consists of Horace E. Dodge, president; William M. Horn, secretary and treasurer; Kenneth M. Smith, managing director and director of sales; U. Dillman, and Anna Dodge Dillman.

Otto J. Groehn returned to the Clayton & Lambert Manufacturing Co., on Dec. 1 to become vice-president and general manager.

John Pritchard has been added to the staff of the Cleveland office of the Bohn Aluminum & Brass Corporation.

R. G. Olson, Manager of the Milwaukee branch of the American Blower Co., has been appointed manager of the Cleveland branch.

Robert J. Wilson, former President and General Manager of the Kempsmith Manufacturing Co., Milwaukee, Wis., has become general manager of the Indestro Manufacturing Co., Chicago, Ill.

D. E. Skinner, Assistant Director of Engineering of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, has been nominated for the presidency of the American Institute of Electrical Engineers, to take office on Aug. 1, 1931. W. B. Kouwenhoven, W. E. Freeman, Paul H. Patton, A. W. Copley, and L. B. Chubbuck have been nominated for vice-presidents, and L. W. Chubb, B. D. Hull, and H. R. Woodrow for directors. Dr. Frank Conrad of Pittsburgh has been awarded the Edison Medal for "His contributions to radio broadcasting and short-wave radio transmission." The medal was founded by associates and friends of Mr. Edison to be awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts."

W. H. Stone, formerly president of the U. S. Hoffman Machinery Co., and previously identified with the Maryland Steel Co. and the American Locomotive Co. in executive capacities, has been named president and general manager of the re-organized David Maydole Hammer Co., which plans to re-open its plant in Norwich, N. Y., shortly after the first of the year.

Jerome Strauss, Chief Research Engineer of the Vanadium Corporation of America, New York, will address a joint meeting of the Chicago section, S.A.E., and the Chicago chapter, A.S.S.T., at the City club of Chicago, on Thursday evening, Dec. 11, on the subject "The Corrosion-Resisting and Heat-Resisting Steels."

Herbert M. Wilcox, operating manager of Electrical Research Products, Inc., a subsidiary of the Western Electric Co., Chicago, has been elected a vice-president.

E. H. Vedder of the Westinghouse Electric & Manufacturing Co., will speak on "The Electron Tube—a New Tool in Industry," at the Jan. 5 meeting of the Cleveland section A.S.M.E.

Samuel H. Worswick, Pacific Coast Representative of the Taylor Instrument Co., Rochester, N. Y., for the past 16 years, with headquarters in San Francisco, has resigned, effective Jan. 1. His successor is G. H. Linsley, Jr., who has been associated with Taylor in San Francisco for the past few years.

T. G. Whitcomb, assistant to the late James A. Whitcomb, President and Manager of the Whitcomb Wheel Co., Kenosha, Wis., for the past eight years, has been appointed president.

OBITUARIES

William S. Ingraham, 73, Treasurer and General Manager of the E. Ingraham Co., Bristol, Conn., for the past 38 years, died Dec. 14 at his home in Bristol. Mr. Ingraham had been an executive of the clock company for more than 50 years. Mr. Ingraham was also a director of the Bristol Brass Co. and the American Silver Co.

Earl E. Bowden, 32, District Sales Manager of the American Electric Motor Co. at Milwaukee, died on Dec. 4 after a brief illness.

Randolph Ortman, 66, formerly president and later board chairman of the American Manganese Steel Co., Chicago Heights, Ill., died on Dec. 8 in the University hospital, Charlottesville, Va. He was a director of the American Brake Shoe & Foundry Co., and the American Forge Co.

Henry K. Lee, head of the Hartford, (Conn.) Engine Works, died Dec. 15. He was born in Philadelphia 75 years ago. Mr. Lee has spent his entire life in the engine business.

FORTHCOMING MEETINGS

SOCIETY OF AUTOMOTIVE ENGINEERS—Annual meeting, Detroit, Jan. 19-23, 1931. John A. C. Warner, 29 West 39th St., New York, secretary.

FIFTH MIDWESTERN POWER & ENGINEERING CONFERENCE AND EXPOSITION—Chicago, Feb. 10-14, 1931. G. E. Pfisterer, 53 West Jackson Blvd., Chicago, secretary.

WESTERN METAL CONGRESS AND EXPOSITION—Second National, Civic Auditorium, San Francisco, Calif., Feb. 16-20, 1931. Under auspices of A.S.S.T. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

THREE-M-CONGRESS — Management, Maintenance, and Materials Handling Congress and Second National Industrial Equipment Exposition, Cleveland, Ohio, April 13-18, 1931. In the Arena and Exhibit Hall, Cleveland Public Auditorium. Information from the A.S.M.E., 29 West 39th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, Engineering Societies Bldg., 29 West 39th St., New York, N. Y. The following meetings are scheduled:

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Materials Handling Meeting and Management congress, Cleveland, April 12-16, 1931.

National Aeronautic Meeting, Baltimore, Md., May, 1931.

AMERICAN FOUNDRYMEN'S ASSOCIATION—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

A little more belief in Santa Claus evidenced itself during the week, with continuing sales of single tools and a slight increase in inquiries of the more solid variety. The Navy continued its issuance of lists, among them an inquiry for two tools for the Mare Island Yard. The Superintendent of Lighthouses, Staten Island, is inquiring for a radial drill and two multiple-spindle sensitive drills. Other inquiries were largely of the single-tool-for-replacement variety. Sales of one dealer included a power bending brake and a large lathe, and several others also sold good-sized units. The Pennsylvania Railroad will ask immediately for bids on 200,000 tons of steel rails for delivery during 1931. At current prices, this order will run over $8,500,000. Attachments for laying will increase the total to more than $15,000,000. The material will be used in continuing the Pennsylvania's program of heavier main line track, therefore, most of the rail will be of the 130-lb. variety. The Carnegie Steel Co. placed a contract with Westinghouse amounting to approximately $10,000. Congress has authorized $165,000,000 for the Boulder Dam project. Bids soon to be asked for include 130,500,000 lb. of steel in various fabricated forms.

CANADA

While conditions have changed very little during the last fortnight, prospects for new business early in January are decidedly bright. Substantial equipment orders are in sight from both major railway systems, it having been already announced that the Canadian Pacific Railway will spend approximately $15,000,000 for rolling stock and equipment. Requirements of bridge building firms and of manufacturers of hydraulic machinery will be particularly heavy during the first quarter of the new year. Manufacturers of structural steel are benefitting by the demand for material for the Consolidated Mining & Smelting Co. $10,000,000 fertilizer plant near Trail, B. C., several units of which are now under construction.

In the eastern provinces, business in automotive parts, especially truck parts, is reported to be good, but passenger car sales continue below normal. Demand for agricultural implements and heavy hardware has declined. In view of the hopeful outlook for car-building plants, three of the leading firms are taking on more employees and preparing for capacity operations.

PACIFIC NORTHWEST

Machine tool and shop equipment houses continue to mark time at the close of a generally unsatisfactory year. However, the market undertone is more optimistic, since there are indications of improved business in the early spring, if not before. Buying hesitation and inventory are retarding sales, and no activity is anticipated until well after the holidays. In this district machinery and equipment sales depend largely upon the logging and lumber industry, which has passed through the worst year in three decades. Under the circumstances operators will not consider new equipment and sales have been confined principally to replacements. However, with prospects of better conditions in logging and lumbering and with some government business in sight, the trade looks hopefully toward 1931.

The U. S. Navy is about to purchase considerable machine shop equipment, including lathes, shapers, two horizontal boring and milling machines and one vertical mill. Specifications are now being prepared and the date for buying these replacements is not known, although it may not be until March 1.

■

SANTA CLAUS may not have a lot of orders right in his bag for machinery and machine tool markets, but indications are that he will be burdened with purchase certificates that will mature after the first of the year. Manufacturers and dealers, donning their amber glasses and peering through the surrounding fog, are beginning to see something more cheerful than the rocks which have been on either side for the past month or two. In fact, New York reports continuing Navy inquiries, and a 3-tool inquiry from the Commissioner of Lighthouses. Sales are also holding well, several of the week's being heavy units. The Boulder Dam project will require 130,500,000 lb. of steel. Canada promises a better new year, including early orders from the railroads, bridge builders, and steel makers inspired by better business.

PACIFIC NORTHWEST optimism is high despite the present slow condition of the lumber industry—from which most machine tool orders in that district come. Navy inquiries are also being issued there. Detroit expects orders from automobile dealers after the first of the year, many of these plants being now closed for inventory. Southern District orders are mainly for used tools. New tool sales are quiet. Chicago's used tool market is also showing improvement, new tool sales are also being made, and inquiries are on the increase. New England patiently awaits an upturn, looking to automotive sources for action if shows turn out well. Cincinnati is also marking time, but at least has done no marching backward. One fair-sized order came from as far away as Malay Archipelago. A fair volume of inquiries was received, and the trade is finding that newer inquiries are the ones being acted upon. More than 500 new tools have been brought out in six months, 20% above average.

DETROIT

Rumors of increased automobile production and a generally favorable forecast for the new year have had a tendency to maintain an optimistic feeling throughout the machinery trade in spite of a decrease in revenue for December. Almost all plants are closing down for inventory, thus diminishing still more the volume of orders for machinery and machine tools. The period of inventory will probably be longer than in normal years, some of the plants having closed as early as Dec. 17 instead of waiting until Christmas as usual.

There are real signs of better times, however. The new year gives promise at any rate of being much better than the 50 per cent of normal recorded in 1930.

SOUTHERN DISTRICT

Business was at a stand-still the past fortnight. Little inquiry other than for absolutely necessary equipment was made, while some circles report a "lying-in-wait" attitude on the part of most buyers. This attitude, it would appear, is predicated on business changes anticipated during the early part of next year. Little is expected in the way of new business between now and then, and most jobbers are simply applying routine measures to their sales departments. This does not, however, apply very strongly to the used machine-tool and machinery markets, extra effort having been and now being exerted to bring stocks on hand to a minimum.

The chief centers, New Orleans, Birmingham, and Houston, were quiet. No change in prices was reported. Industries buying continue varied, with only limited inquiry well scattered geographically. Road construction in Louisiana is going forward at a rapid pace, but dealers in road equipment have not yet felt the demand such a program should reflect.

CHICAGO

The near approach of a new year, from which much is hoped in the way of improved conditions, gives rise to optimism. Inquiries are on the increase, and a few good sales are reported from scattered sources. The used tool market, which for several months has been very quiet, is showing considerable improvement, one dealer reporting more business for the first half of December than for the combined months of October and November. Additional inquiries are coming in from railroads, mostly for single tools. Manufacturers' representatives and selling agents are expectantly awaiting announcement by the Chicago Board of Education outlining requirements in the way of shop equipment for the new Lane Technical High School, the cost of which is estimated at $500,000. This, it is said, may be looked for within the next 60 days. So far as is known, no other lists of importance are in sight.

CINCINNATI

Not much seasonal cheer in the form of orders came to the machine-tool manufacturers in the past week, but the fact that there was no further recession is found gratifying. Business booked was scattered and diversified, the greater part coming from miscellaneous users whose requirements were largely confined to single items. A fair-sized order pending a long time came from the Malay Archipelago. Selling agents report no change, but expect business to take a turn for the better soon.

A fair volume of inquiries was received, being scattered and confined to single tools. Some find that the more recent inquiries most frequently result in sales, but in a few cases old inquiries have been revived and purchases made.

NEW ENGLAND

There has been little, if any, change in the tool situation. The point of focus is beyond Jan. 1. New England industry is well stocked with inquiries, most of which request a 1931 delivery date later than January. Another favorable aspect is the recent inclination of the automotive industry to develop a buying program. The reception of new models at the various shows will determine the extent of the development.

It is apparent that December will do well to even November in totals. A more general business pickup is necessary to stimulate machine tool buying, and for this happy event the trade is patiently waiting.

BUSINESS • BAROMETER

If politico-economic irritation is allayed, internal trade should soon be as large as a year ago

THEODORE H. PRICE
Editor, Commerce and Finance, New York

AS THE end of the year approaches it is in order to review the sensational occurrences that have made 1929 and 1930 unique in the financial history of the world. A detailed record of these years is impracticable, but some idea of the extremes to which security prices have been carried may be had by comparing the "high" and "low" for the common stocks of the New York Central Railroad, the United States Steel Corporation, and the American Telephone & Telegraph Co. from the first of January, 1929, until December 18, 1930. These three corporations have been picked out because their stock is widely distributed and they themselves are regarded as among the best-managed and most securely established companies in their respective fields. The figures show that the value of their common stocks at the high prices of 1929 was $7,410,430,174, and that they had declined to $3,821,047,365 at the low quotations of 1930, touched on December 17.

If the stock market were a mechanical and unemotional device for measuring and recording values, current stock figures might lead us to conclude that the country was upon the verge of politico-economic ruin. But we know that this is not the case. Hence we are compelled to admit that the element of fear must have played an important part in bringing about the recent decline, and that present prices should attract the courageous and reward those who show their confidence by buying securities of merit at current quotations. Fear has, in fact, played such an important part in the recent history of the stock market that human judgment has become almost valueless. It requires courage of a very high order to oppose the demoralization by which stock exchange speculators have been recently obsessed. Rumors that were utterly unwarranted have been circulated about nearly every important financial organization in the United States, and the number of small bank failures reported have added to the confusion and fear.

It is said that there have been over a thousand bank failures in the United States during the year 1930, and numerous small institutions in North Carolina, South Carolina, and Arkansas were compelled to suspend last week. In London silver has declined to 14½ pence per ounce. This is the lowest price on record, and many European economists are insisting that the depreciation of silver has caused an impairment in the purchasing power of India and China that is largely responsible for the present depression. For this reason the question of silver versus gold as a standard of value is being more and more discussed and it may become a political issue again in some places.

The United States Department of Agriculture announced that the value of our principal crops in 1930 was about $6,275,000,000, as compared with $8,675,000,000 in 1929. Of course, the present depression is in a measure explained by the reduced purchasing power which these figures reflect. For this reason it is to be hoped that the Federal Farm Board will soon be able to accomplish the purpose for which it was appointed and furnished with the money at its disposal. It is being much criticized for its tardiness in getting results, but it faces a difficult problem. It may be that a solution is impossible, but the American people are disposed to believe that their government is invincible, and they are not yet prepared to admit that it is impossible to abate the hardship of what we call the law of supply and demand.

Commodities have fluctuated in sympathy with the stock market. Sugar had a sinking spell when the refusal of Germany to join in restricting her exports of beet sugar was announced. Some think that this refusal may be reconsidered a month hence, but others insist that a golden opportunity has been passed and lost. As stocks went down cotton and cotton goods declined afresh, but there has been a slight recovery.

The strikes in Spain and the revolution that is reported from Guatemala are supposed to be political in their inspiration, but the facts are hard to get. Those who are best informed think that the low wages paid to Spanish labor is the chief cause of the unrest in that country.

Washington reports continue to reflect more or less disaffection between the President and the Senate. A compromise has been reached on the Drought Relief Bill by which $15,000,000 instead of $30,000,000 will be added for food relief, which Mr. Hoover had opposed, but control of allotting the $116,000,000 voted for unemployment relief has been restored to him, and it is probable that both bills will have been passed before this is read. If not, great dissatisfaction will manifest itself among the wage-earners and the farmers of this country.

Car loadings for the week ending Dec. 6 shows a decrease of about 20 per cent as compared with last year. Private reports of distributive trade indicate a similar decrease in the turnover. If the politico-economic irritation that has been created in Washington is promptly allayed our internal trade should soon be as large as it was a year ago at this time.

THE BUSINESS WEEK

December 24, 1930

AS WE draw nearer the end of this year, there are a few faint signs that business is beginning to pull itself together in preparation for an effort to turn the tide when the next one begins. . . . Resistance to further decline has stiffened slightly, as the wave of liquidation has become heavier. . . . Although our index of business activity fell somewhat further, from 77.5% of normal to 76.3%, steel production held up against the usual seasonal down trend, electric power production was fairly well sustained, merchandise carloadings were somewhat higher than the seasonal expectation, and the volume of commercial loans and currency in circulation continued to expand. . . . Firmness in steel prices is being maintained, and both security and commodity markets give encouraging indications of reaction to excessive liquidation under more deliberate support. . . . It is being more clearly recognized that while liquidity is laudable, it is not quite necessary to have a second Flood to wash out the Economic Sins of the new era. . . . As soon as this realization results in more aggressive and sustained support of the seriously weakened bond market by the stronger commercial banks, aided by the Federal Reserve System, the basis for business recovery will be laid, but not before. . . . Reasons for failure to do something of this sort look more convincing from the sidelines than they do from the breadlines.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

A TENDENCY is current among iron and steel users to contract for tonnages to be delivered throughout the first half of 1931. It would appear from this that buyers expect prices either to remain steady or to go higher. The Pittsburgh mill base for first-quarter business on steel shapes, plates and soft bars now ranges between $1.60 and $1.65 per 100 lb. A few weeks ago, the asking price for first quarter was placed at $1.65, flat. Slab zinc is quoted at 4c per lb., E. St. Louis, as against 4.17½c., last week. Babbitt and solder declined 1c. and ¾c. per lb., respectively, at New York warehouses. Raw linseed oil, 1 to 4 bbl. is off 0.4c. per lb., to 9.6c., f.o.b. New York.

(All prices as of Dec. 19, 1930)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
No. 2 Southern (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	20.41@ 20.91
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	14.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	18.26@ 19.26
Virginia No. 2 (Silicon, 1.75@2.25)	22.29
Basic	17.75@ 18.25
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.51
PITTSBURGH: including freight charge, $1.76, from Valley)	
No. 2 Foundry	18.76
Basic	18.76
Bessemer	19.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75@5.00
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	1.90	3.35†	3.00	3.40†
No. 12	1.95	3.45†	3.10	3.45†
No. 14	2.05	3.55†	3.20	3.50†
No. 16	2.15	3.65†	3.30	3.60†
Black				
Nos. 18 to 20	2.15@2.25	3.60†	3.40	3.70
No. 22	2.30@2.40	3.75†	3.55	3.85
No. 24	2.35@2.45	3.80†	3.60	3.90
No. 26	2.45@2.55	3.90†	3.70	4.00
No. 28	2.60@2.70	4.05†	3.85	4.15
Galvanized				
No. 10	2.20@2.30	3.65†	3.50	3.55
Nos. 12 to 14	2.30@2.40	3.75†	3.60	3.65
No. 16	2.40@2.50	3.85†	3.70	3.75
No. 18	2.55@2.65	4.00†	3.85	3.90
No. 20	2.70@2.80	4.15†	4.00	4.05
No. 22	2.75@2.85	4.20†	4.05	4.10
No. 24	2.90@3.00	4.35†	4.20	4.25
No. 26	3.15@3.25	4.60†	4.35	4.50
No. 28	3.40@3.50	4.85†	4.70	4.75

*Light Plates. †400 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
⅝	.58½	2.875	2.469	.203
¾	.76½	3.5	3.068	.216
⅞	.92	4.0	3.548	.226
1	1.09	4.5	4.026	.237
1½	1.48	5.563	5.047	.258
2	1.92	6.625	6.065	.28
2½	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

—Thickness— Decimal	B.w.g. and Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	⅝	¾	1	1¼	1½
		Price per Foot								
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23		
.049″	18	.17	18	.19	.20	.21	.23	.25		
.065″	16	.19	.20	.21	.22	.23	.25	.27		
.083″	14	.20	.22	.23	.24	.25	.27	.29		
.095″	13	.21	.23	.25	.26	.27	.29	.31		
.109″	12	.22	.24	.26	.27	.28	.30	.32		
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33		
.134″	10	.24	.26	.28	.29	.30	.32	.34		

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.15
Hoop steel	3.75†	4.00	3.75†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.85†	5.30	5.00†
Cold fin., round or hexagon‡	3.40	3.65	3.35
Cold fin., flat or square‡	3.90	4.15	3.85
Structural shapes	3.10†	3.00	3.00†
Soft steel bars	3.10†	3.00	3.00†
Soft steel bar shapes	3.10†	3.00	3.00†
Soft steel bands	3.40†	3.65	3.20†
Tank plates	3.10†	3.00	3.00†
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick by ¾-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ½, 7.35c. per lb.

METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

Copper, electrolytic, New York			12.00@12.50
Tin, Straits, pigs, New York			26.50@27.50
Lead, pigs, E. St. Louis	4.95	New York	6.00@ 7.00
Zinc, slabs, E. St. Louis	4.00	New York	5.75@ 6.75

	New York	Cleveland	Chicago
Antimony, slabs	9.50@10.50	10.50	10.75
Copper sheets*	20.75	20.75	20.75
Copper wire*	13.25	13.37½	13.37½
Copper, drawn, round*	19.25	19.25	19.25
Copper tubing*	23.12½	23.12½	23.12½
Brass sheets, high*	17.87½	17.87½	17.87½
Brass tubing, high*	22.75	22.75	22.75
Brass rods, high*	16.12½	16.12½	16.12½
Brass wire, high*	18.37½	18.37½	18.37½

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	24.00@25.00	24.30	23.30
Zinc sheets (casks)	9.75@10.25	11.25	10.36
Solder (½ and ½)	21.50	21.50	20@22
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			45.00
Commercial genuine, intermediate grade			34.00
Anti-friction metal, general service			30.00
No. 4 babbitt, f.o.b.			10.00

†F.O.B.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	8.00	8.50	7.25@7.75
Copper, heavy, and wire	7.50@7.75	8.00	6.75@7.25
Copper, light, and bottoms	6.75@7.00	7.25	6.00@6.50
Heavy lead	3.75@4.00	4.00	3.00@3.50
Lead battery plates	2.00	....	....
Brass, heavy, yellow	4.50@4.75	6.50	4.00@4.50
Brass, heavy, red	7.25	9.50	6.25@6.75
Brass, light	3.50@3.75	5.50	3.50@4.00
No. 1 rod-brass turnings	5.00	5.50	4.00@4.50
Zinc	1.50@1.75	1.50	1.25@1.50

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13	$0.16	$0.15
Cotton waste, colored, per lb.	.09½	.12	.10
Wiping cloths, washed, white, per lb.	.14	38.00 per M	.14½
Sal soda, per lb.	.01¾	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.096	.104	.10
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30%	30 –5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	60%	50–10%	50%
Second grade	60–5%	60– 5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.031	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.035
Brass rods	per lb.	.1612½	.1687½	.2125
Solder (½ and ½)	per lb.	.215	.225	.295
Cotton waste, white	per lb.	.13	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.65	.65	.65
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65%*	65%*	50–10%*

*List prices as of April 1, 1927

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	.90	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.40@2.50		
Coke, prompt foundry, per net ton	Connellsville, 3.50@4.85		
White lead, dry	100 lb. kegs	New York, 13.75	
White lead, in oil	100 lb. kegs	New York, 13.75	
Red lead, dry	100 lb. kegs	New York, 13.75	
Red lead, in oil	100 lb. kegs	New York, 15.25	

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.50
Structural, round head, broken kegs, net	6.00
Tank, 7/16-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Ill., East St. Louis—W. Shannon, 1129 Missouri Ave.—acetylene welding outfit.

Mo., St. Louis—Teuscher Pulley & Belting Co., 801 North Second St.—hammer mill.

Mich., Detroit—Lamb Co., Wright and Iron Sts. (sheet metal work)—Toledo Horning Press No. 14½ or similar, power shear, 36 to 42 in. wide for 14 gauge stock.

Mich., Detroit—Rex Tool & Die Co., 5680 12th St.—shaper and equipment.

Opportunities for Future Business

Ark., Little Rock—City Airport Commission, P. L. Robinson, City Hall, Mayor, authorized the purchase of an 80 acre site for extensions and improvements including hangars, shops, filling station, etc. Estimated total cost $200,000. E. E. Stansberry, Engr.

Calif., Fruitvale—Oliver United Filters Co., 4th and Madison Sts., Oakland, will soon receive bids for the construction of a new plant for the manufacture of filtering equipment, mining machinery, etc., here. Estimated cost $400,000. Reid & Corlett, Oakland Bank of Savings Bldg., Archts.

Calif., Oakland—R. C. Hoyt, c/o F. C. Stolte, 3455 Laguna St., Contr., awarded contract for the construction of a 1 story, 40 x 120 ft. machine shop at East 10th and High Sts.

Conn., Bridgeport — New Era Construction Corp., R. D. Zappone, 511 5th Ave., New York, N. Y., plans the construction of a storage warehouse at Noble Ave. and Harriett St. Estimated cost $100,000. Architect not selected.

Conn., Hartford—New England Electric Co., 103 Allyn St., will soon award contract for the construction of a service and storage building at Spring and Church Sts. Estimated cost $75,000 to $100,000. Westcott & Mapes, 139 Orange St., New Haven, Archts. Noted Dec. 11.

D. C., Washington—J. E. Hurley, 1219 Ohio Ave., N. W., plans a 1 story, 75 x 93 ft. machine shop. Estimated cost $25,000. G. T. Santmyers, 1418 I St., Archt.

Ill., Chicago—Commonwealth Edison Co., 72 West Adams St., awarded masonry and carpentry contracts for a 1 story, 44 x 60 ft. substation at 121 North Dearborn St., 1 story, 27 x 32 ft. sub-station at 10166-68 Malta St., and 1 story, 73 x 118 ft. addition to laboratory at 3507-11 North California Ave. Estimated cost $78,000.

Ill., Galesburg—Rowe Mfg. Co., A. Y. Rowe, Pres., 614 West Third St., manufacturers of farm implements, plans to rebuild 1 and 2 story factory on West 3rd St. recently destroyed by fire. Estimated cost $50,000. Architect not selected.

Ind., Hammond—Holliday Steel Co., awarded contract for the construction of a 220 x 225 ft. plant. Estimated cost $100,000.

Ky., Frankfort—Dept. of Charities & Corrections, plans the construction of a factory for the manufacture of automobile license tags at State Penitentiary. Estimated cost $45,000.

Me., Bangor—A. E. Webber, 75 West Broadway, awarded contract for a 1 story, 90 x 120 ft. service garage on West Broadway. Estimated cost $50,000.

Me., Bucksfield—C. Witherton & Son, plans the construction of a broom factory. Estimated cost $40,000. Private plans.

Mass., Brockton—Taunton Lumber Co., 243 North Montello St., plans the construction of a warehouse. Estimated cost $50,000. R. P. Jackson, 106 Main St., Brockton, Engr. Noted Oct. 30.

Mass., Charlestown (Boston P. O.)—Bureau of Yards & Docks, Navy Dept., Washington, D. C., plans the construction of a steel storage plant and crane for Marine Railway at Navy Yard here. Estimated cost $2,000,000. Private plans.

Mass., Springfield—Bd. of Education, plans addition to technical high school. Estimated cost to exceed $150,000. Architect not selected.

Mass., Watertown—New England Telephone & Telegraph Co., 50 Oliver St., Boston, will soon receive bids for a 1 and 6 story, 85 x 265 and 120 x 140 ft. garage and warehouse at Mount Auburn and Grove Sts. Estimated cost $40,000. Monks & Johnson, 99 Chauncy St., Boston, Engrs.

Mass., Worcester—Dept. of Public Buildings, City Hall, awarded contract for the construction of a work shop at East Worcester and Shrewsbury Sts. Estimated cost $40,000. Noted Oct. 9.

Mo., St. Louis—Century Electric Co., 1806 Pine St., will build a 1 story, 43 x 94 and 41 x 286 ft. addition to foundry at 3763 Market St. E. J. Lawler, 3727 Market St., Archt. Work will be done by separate contracts.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

N. J., Hackensack — Standard Oil Co., M. Roberts, Bayway, is having plans prepared for the construction of a 1 story, 115 x 120 ft. garage, 50 x 80 ft. warehouse, and 25 x 50 ft. pump house. Estimated cost $150,000. Private plans.

N. J., Jersey City — Motoramp Garages of New Jersey Inc., J. V. Coyle, Pres., 250 Park Ave., New York, N. Y., awarded contract for a 6 story garage at Bergen Ave. and Academy St., here. Estimated cost $500,000.

N. J., Sommerville—Bd. of Education, Somerset County, Court House, postponed construction of a 2 story vocational school. Estimated cost $150,000. Project abandoned. Noted Oct. 16.

N. Y., Attica—Dept. of Correction, Capitol, Albany, will receive bids until Jan. 27 for a group of buildings, including administration building, shop building, textiles shop building, maintenance storehouse, etc., at State Prison here. Estimated cost $1,000,000. Noted Oct. 2.

N. Y., Flushing—Michaels Bros. Furniture Co., 5th Ave. and 9th St., Brooklyn, awarded contract for the construction of a workshop, storage building, etc., on Main St., here. Estimated cost to exceed $40,000.

N. Y., Napanoch—Dept. of Correction, State Capitol, Albany, will receive bids until Jan. 20, for the construction of a shop and storage building at State Institution for Defective Delinquents here. Noted Nov. 6.

N. Y., New York—S. Mayer, 41 East 72nd St., plans the construction of a 7 story service garage at 158 East 84th St. C. Schaefer, Jr., Archt. Maturity summer 1931.

N. Y., Oswego — State Dept. of Education, State Capitol, Albany, will receive bids February for the construction of an 80 x 200 ft. industrial teacher's training building here. Estimated cost $300,000.

Pa., Altoona—Goodrich Tire & Rubber Co., W. B. Thompson, 500 South Main St., Akron, O., awarded contract for the construction of a 1 and 2 story, 49 x 163 ft. service station, garage, storage building, etc., on 12th St. here. Estimated cost $40,000. Noted Nov. 13.

Pa., Oil City—National Transit Co., F. D. Williams, Pres., Seneca and Center Sts., awarded contract for a 1 and 2 story, 156 x 285 ft. machine shop, warehouse, office, also changing foundry into assembly shop. Noted Dec. 18.

Pa., Pittsburgh—F. A. Donatelli, 7202 Appel St., awarded contract for a 2 story, 50 x 50 ft. garage, warehouse, etc., at 7242-7244 Forest Way. Estimated cost $50,000.

Pa., Pittsburgh—Singer Sewing Machine Co., W. Clough, 149 Broadway, New York, N. Y., is having plans prepared for the construction of a plant at 443 Wood St. Estimated cost $200,000. Janssen & Cocken, Century Bldg., Archts.

Tex., El Paso—Hotel Hussman Co., is having preliminary plans prepared for the construction of a garage, etc. Estimated cost $230,000.

Tex., San Antonio—War Dept., A. W. Robins, Duncan Field, is having plans prepared for the construction of a 4 story, 250 x 600 ft. air service mechanical repair shop. Estimated cost $500,000. Engineering Dept., Wright Field, Dayton, O., Archts. and Engrs.

Wash., Seattle—Bacon & Mateson Forge Co., 17 West Lander St., plans to rebuild part of plant recently destroyed by fire.

Wis., Milwaukee — J. Rouschenberger, 30th and Hadley Sts., manufacturers of cordage and twine will soon award contract for a 1 story, 73 x 340 ft. factory on 30th St. Dick & Bauer, 208 3rd St., Archts.

Wis., Milwaukee—Wrought Washer Co., 46 South Bay St., awarded contract for the construction of 150 x 257, 133 x 209 and 96 x 340 ft. factory buildings, all 1 story. Estimated cost $175,000.

Ont., Kingston—Bd. of Education, plans the construction of a 3 story technical and vocational school. Estimated cost $350,000. C. Drever, 81 Brock St., Archt.

Ont., Toronto—H. S. Howland & Sons Ltd., 138 Front St. W., manufacturers of hardware, is having plans prepared for the construction of a 3 or 4 story warehouse. Estimated cost $175,000. Langley & Howland, 146 King St. W., Archt.

Que., Montreal—Bonna Pipe Co. of Canada Ltd., plans the construction of a plant for the manufacture of steel, reinforced concrete pipe, etc.

Argentina, Buenos Aires—Firestone Tire & Rubber Co., Main St., Akron, O., awarded contract for the construction of a new tire manufacturing plant and power house here.

AMERICAN MACHINIST

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—And All Through The House

(As Well as the Senate)

IN the weeks before Christmas, this year, there has been a notable revival of the time-honored belief in the governmental Santa Claus. Hardened congressmen and hoary solons alike have donned the false beard of fiscal benevolence and are trying to climb down the devious chimneys of political favor to gladden the cheerless hearths of their child-like constituents with glittering gifts from the bottomless bag of the Treasury Department. When the overworked paterfamilias in the White House objects he is charged with callous skepticism about the reality of Santa Claus, and Congress is divided in bitter debate on the Kris Kringle question.

At the risk of appearing unseasonably cynical, we wish the old boys in Washington would drop this Santa Claus stuff and quit trying to kid their constituents into believing in the old gent, whether he be disguised as Andrew Mellon or anybody else.

A fair proportion of American business men are adult; they know where the Christmas presents of government come from and who pays the bills. The theory that government can make everybody happy by taxing those who have, to distribute it among those who haven't, seems to them an economic myth that looks as pretty as a Christmas card on paper, but where it is tried out, as it is in socialist Europe, soon leads to the conclusion that there ain't no Santa Claus, even beneath the whiskers of Karl Marx.

They are perfectly willing to make their contribution to the neediest cases, where drought or other misfortune has made relief necessary, but they do not see that prosperity can be restored by handing everybody gifts from the government Christmas tree, and they have especially little good will at this season toward those overgrown infant industries who won't eat their spinach and are still crying for an all-day sucker in the form of subsidy or other special favors. When Santa Claus comes down the chimney with a magnificent new merchant marine, an overflowing Hawley-Smoot grab-bag, a fine old Farm Board, a great big Rivers and Harbors Bill, or a pretty new public works appropriation, cheerily crying "Noel," we know well enough that it's only old Mr. Taxpayer dressed up for the occasion.

So the grown-ups of this nation, young as we are, wish that the fond old folks in Washington would this year cease trying to fill our somewhat empty Christmas stocking with tinsel trinkets from the Treasury. It would make us much merrier, we feel, if they would first try to darn some of the holes in the stocking, so that in future years some of our more substantial blessings might not slip through the toes.

A little less enthusiasm about governmental regulation and bright new bureaucratic machinery, a little more careful long-time planning of public expenditures, a little more earnest international cooperation in checking the building of barriers to foreign trade, lightening debt burdens and facilitating the normal growth and distribution of world credit resources—all these things would help American business itself to deck the Christmas tree of prosperity with the substantial gifts of our natural resources, our free initiative and intelligence, without resort to the infantile nursery-tricks of a governmental Santa Claus. He can never produce anything from his bag which someone's industry has not first put these, and he wastes a lot of time and energy tying it up in tinsel and red-tape and climbing around in the sooty chimneys of politics trying to distribute it equally, without ever satisfying anybody or fooling anybody anyway.

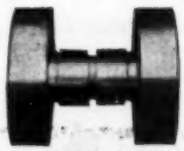
—Editorial from Dec. 24th
THE BUSINESS WEEK

THE JOHNSON FRICTION CLUTCH

1930 BROUGHT TO MACHINERY BUILDERS THRUOUT THE WORLD

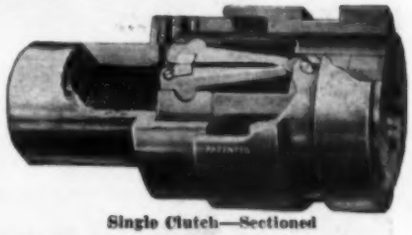
THE NEWER

Double Clutch—Exterior



Double Clutch with Pulley

FINER
MORE RELIABLE
SUPER-
JOHNSON
FRICTION CLUTCH
TO
EQUIP
THEIR MACHINERY WITH



Single Clutch—Sectioned

Single Clutch with Pulley

WIRE, PHONE Or
WRITE FOR CATALOG "BLUE—124"

Merry Xmas!

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

14 inch Selective Head Tool Room Lathe

Your Best Insurance For Tool Room ACCURACY

THIS Lodge & Shipley Selective Head Lathe has found a definite place in the tool rooms of some of America's most exacting manufacturers.

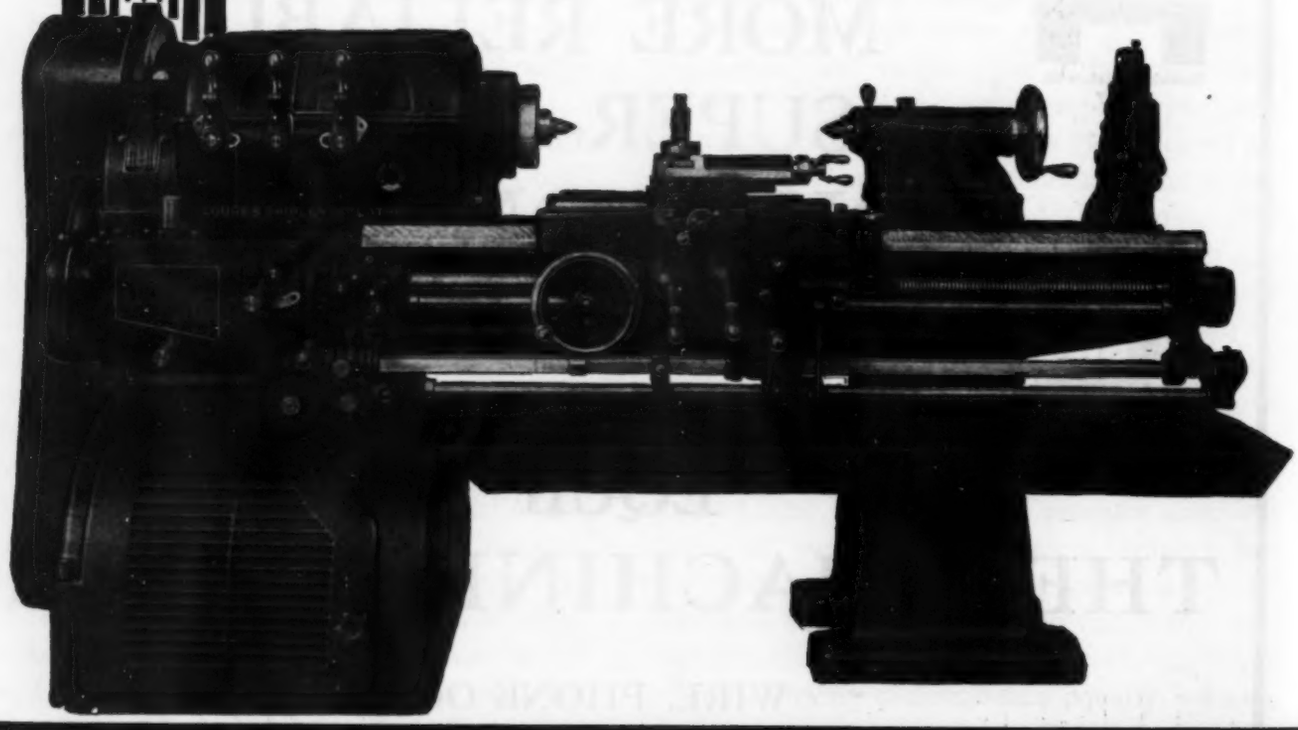
Its ability to maintain close tolerances on particularly accurate work is your best insurance for accuracy on any tool room job.

In fact the sturdy, rugged construction combined with compact, clean cut design enables you to produce accurate work continuously.

Look over the features listed and see for yourself why Lodge and Shipley Tool Room Lathes have gained such a wide acceptance.

Features

Simplified construction of 12 Speed Headstock; Double Nose Spindle; great range of Threads and Feeds; New Type Apron; Reverse to Carriage; Chilled Ways on bed; Chilled carriage cross-slide, and on compound rest top slide; Self-contained Motor Drive.



THE LODGE & SHIPLEY
CINCINNATI,

.....Makes Small Lots Profitable DUOMATIC

THIS full automatic Lathe differs from most automatic machines in that it is not only economical for quantity production but very profitable on lots down as small as 100 to the lot, and in many cases even smaller.

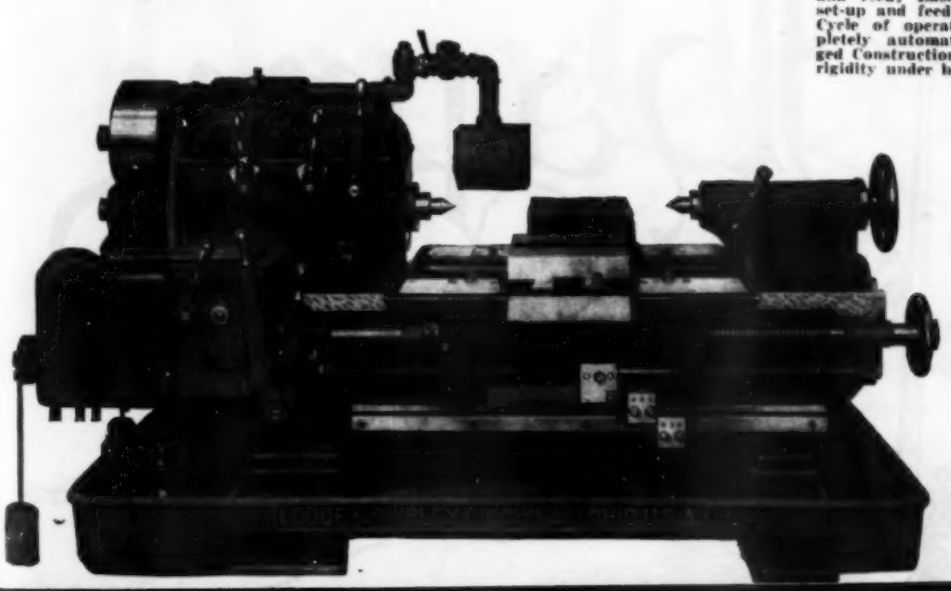
The cycle of operation is completely automatic including locating diameters and lengths on the work piece. Diameters and lengths are obtained by positive metal to metal stops.

Tools work simultaneously from each side or from side and an end of work and numerous other combinations. All feeds and quick traverse up to work is accomplished through gearing. There are no cams used.

Ease of set up results, enabling operator to change over quickly from one job to another without tearing down entire machine.

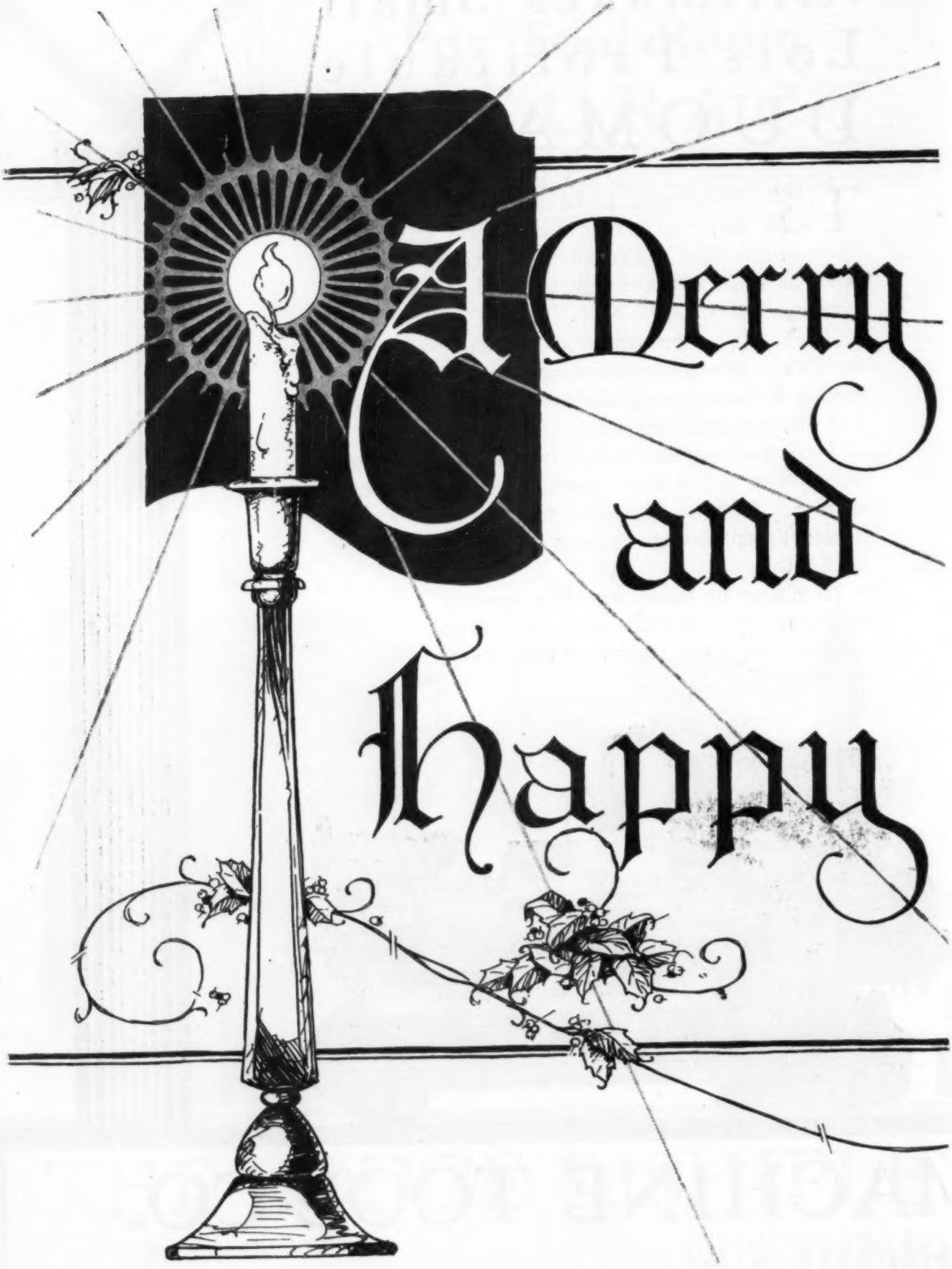
Features

Two complete carriages and tool slides with independent power traverse and feed; Ease of tool set-up and feed changes; Cycle of operation completely automatic; Rugged Construction insuring rigidity under heavy cuts.



L & S MACHINE TOOL CO.

OHIO, U. S. A.


A Merry and Happy

Christmas

a

New Year!

A thorough survey of our business combined with a study of the predictions of others in industry, lead us to expect a healthy improvement in business in 1931. And so with the greetings on these pages, go our sincere wishes that you may enjoy a goodly share of this increased activity.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI, OHIO, U.S.A.

UP GO THE DEMANDS ON SPINDLES AND THE ANSWER IS

Higher cutting speeds—deeper cuts—greater production per machine—lower machining costs . . . all these things are forecasted as the new and harder tool alloys come into more general use.

That makes Timken Bearings on spindles even more of an economic necessity than they have been before. For to reap the greatest benefit from the harder tool alloys demands the extra load area, rigidity and endurance that come only with the exclusive combination of Timken tapered construction, positively aligned rolls and Timken steel.

The economies of Timken Bearings on spindles are already so important that their use has become almost universal. But the newer machining practices effected by harder tools make Timkens a *vital necessity*. Before purchasing, weigh this question carefully—will the *bearings* in the spindles of the machines you buy today get the most from the harder tools you can buy tomorrow? Make sure of Timkens.

THE TIMKEN ROLLER BEARING COMPANY
C A N T O N, O H I O

TIMKEN
Tapered
ROLLER BEARINGS

The

CINCINNATI BICKFORD TOOL COMPANY

Wishes You

A Very Merry
CHRISTMAS
and a
Happy **NEW YEAR**

Do you buy tools on the basis of price or value?

PRICE
is what you pay for them

VALUE
what they pay you.

In buying screw thread dies the die which during its life produces the greatest number of acceptable screws at the lowest cost per screw is the most economical die at any price.

JONES & LAMSON MACHINE COMPANY has recently announced the new J&L Tangent Die.

It is recommended to the trade with J&L's full endorsement as a tool that is scientifically made to cut accurate screw threads on a high production basis.

It is made for long wear under hard service.

Our own experience with this die and its long wear chasers convinces us that it is the most economical screw thread die on the basis of

COST PER SCREW

THE J&L TANGENT DIE

Ground throughout on all dimensional surfaces. Positive rigidity of chaser control. - -

Chasers that barely clear face of die body reducing overhang to the minimum. - - - -

Chasers ground in the thread for accuracy.

Chasers sharpened on the end for long life.

Chasers which, worn to the limit, cut as close to shoulder as a new set. - - - - - - - -

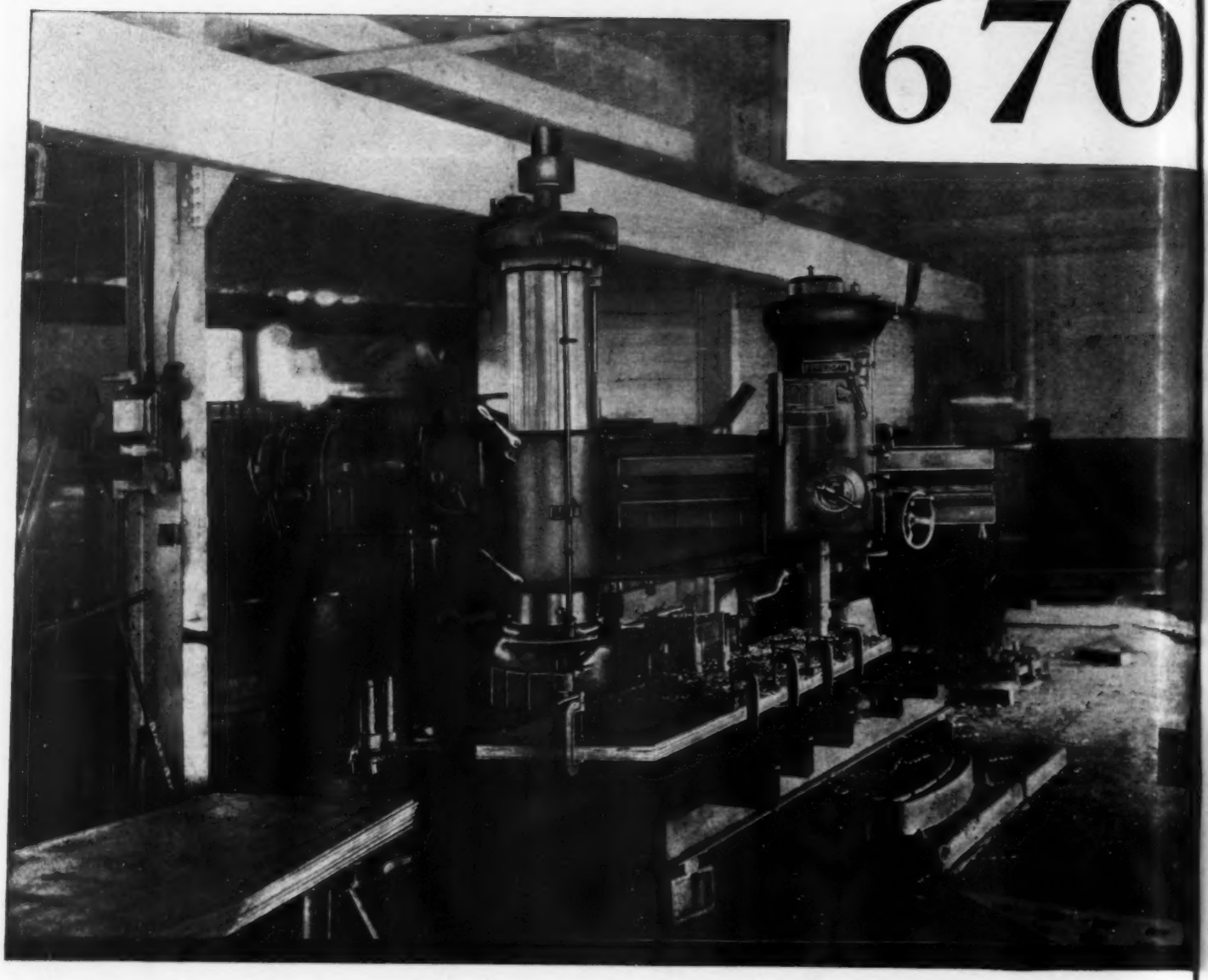
Chasers guaranteed to be accurate in shape, spacing and helix angle. - - - - - - - - -

Chaser sharpening performed to definite measurement, eliminating the element of personal judgment. - - - - - - - - -

Die Head and Holders of an accuracy equal to the chasers. - - - - - - - - -

Finally, a tool bearing the J & L trade mark and considered by the company a fitting complement to its other high-grade products.

JONES & LAMSON MACHINE CO., Springfield, Vt.



670

LATHES
RADIALS
SHAPERS

"AMERICAN"

HOLES

at one setting—

and each hole at ¼ of former cost

This is a comparatively simple set-up but the cost per hole is about one-fourth the former method.

10 sheets at one time—67 holes in each—a total of 670 holes—sizes ranging from 7/16 in. dia. to 13/16 in. dia.—production increased and costs lowered—this in brief tells the production story on the job illustrated.

However this American Triple Purpose Radial is used on many other jobs but the net result is always the same—a better job—greater production—and a lower cost per hole.

And as to manitenance it's so low that it barely affects the costs on year-in and year-out production.

It will pay you to know all about the American Triple Purpose Radial. Where shall we send the information?

AMERICAN

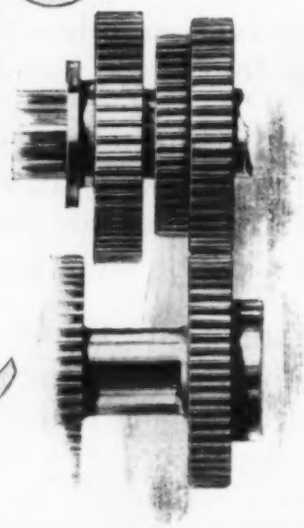
Triple Purpose

RADIAL

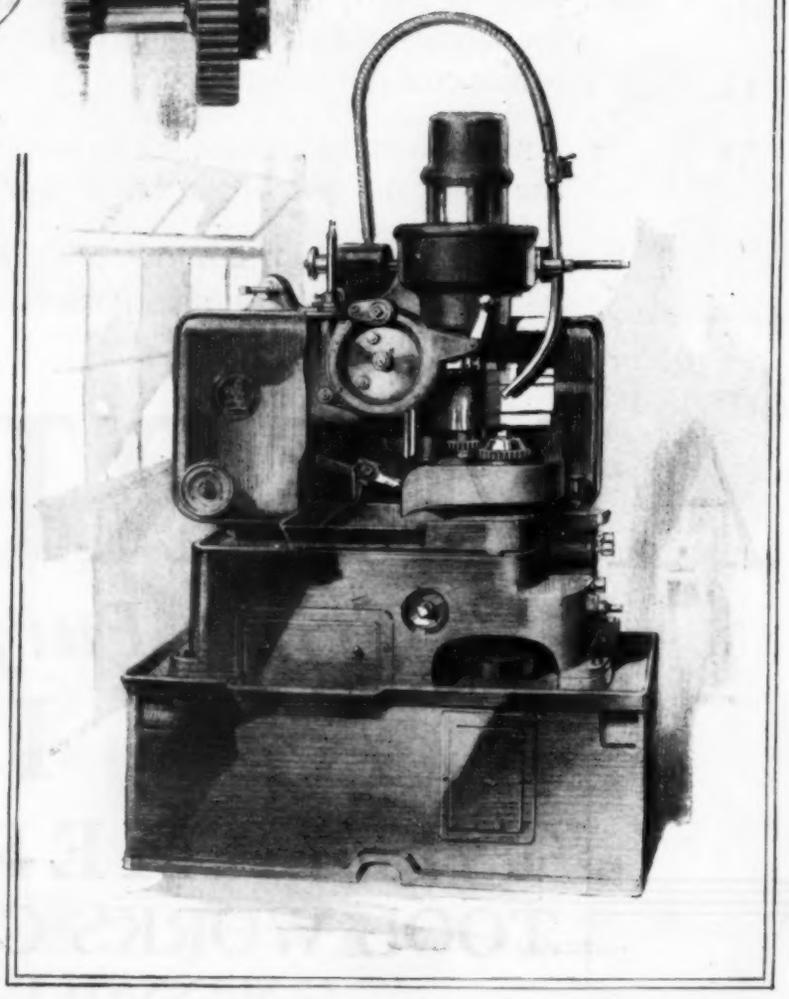
THE AMERICAN TOOL WORKS COMPANY

CINCINNATI, U. S. A.

Quiet



Only with



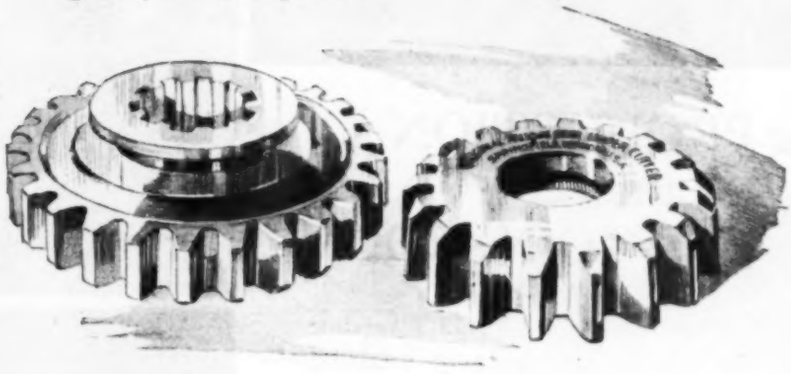
The Fellows High Speed Gear Shaper — for production gear cutting to the highest precision standards

Accurate Gears!

. . and to count the dollar value of QUIET, *as achieved by generating on Fellows machines,* we quote:

"FOR the first time in our history," said the manager of one of the biggest automobile plants, "we are turning out transmissions with actually no charge for tear-downs. Why, before we put in the Fellows machines, we were carrying an assessment charge of one dollar for every car on the line to cover the cost of tearing down noisy gear assemblies—and I'd say even that was too little. Now we are turning out good transmissions and costs were never so low."

Gear accuracy alone will not produce quiet. Other conditions, too, must be right. But inaccurate gears can cause unceasing trouble. The experience quoted above is common to many manufacturers who have come to adopt the Fellows Gear Shaper principle as a means of improving the quality of their product.

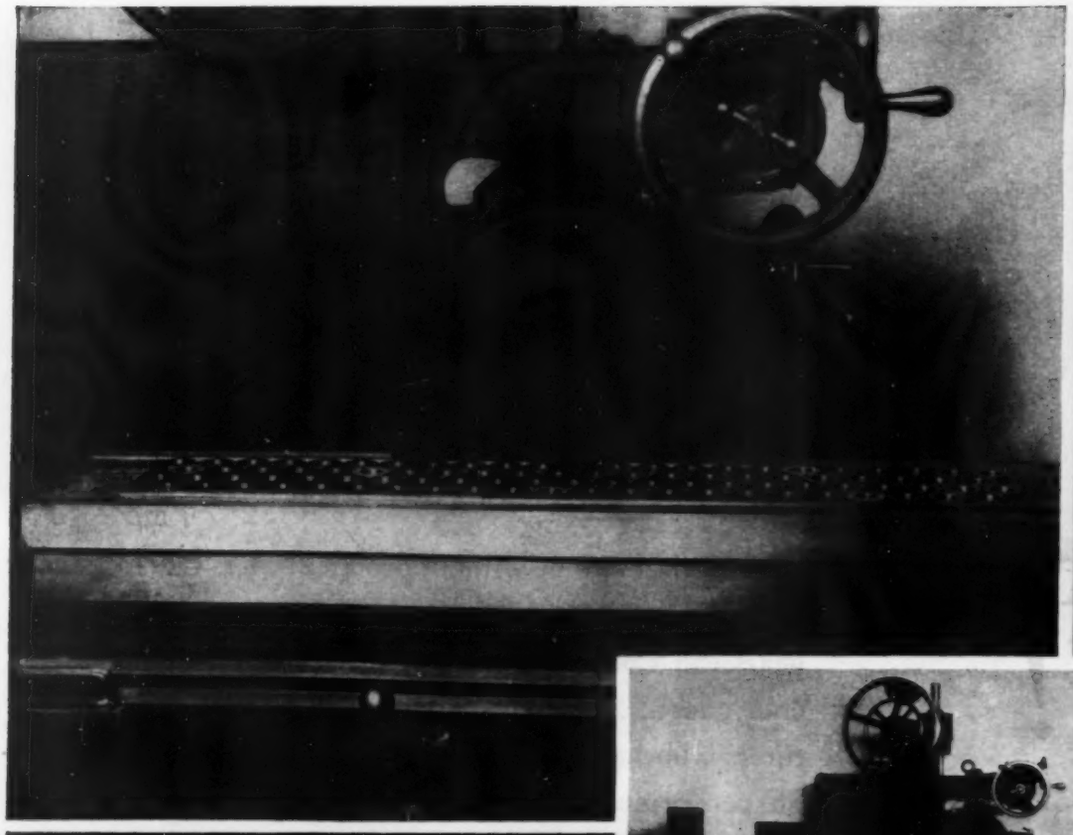


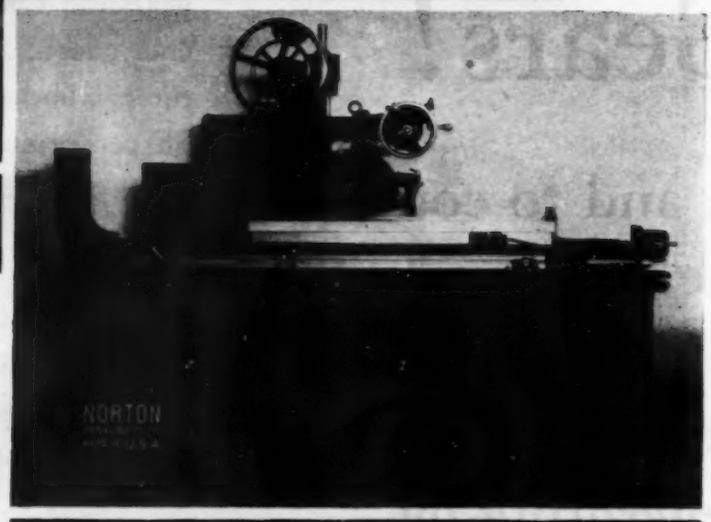
Tell us what gear problems confront you. We have helped others and may be able to assist you. THE FELLOWS GEAR SHAPER COMPANY, Springfield, Vermont, U. S. A. *(or Detroit Office, 1149 Book Building).*

FELLOWS GEAR SHAPERS

Yours for the asking!

This is the fifteenth of a series of "Experience" advertisements. Reprint copies of those preceding are available on request.





For PRODUCTION or the TOOL ROOM

The Norton Hydraulic Surface Grinding Machine is particularly adapted for work requiring close tolerances for size and parallelism and a quality finish.

A simple hydraulic mechanism produces an extremely fast table traverse with smooth reversal and free from vibration.

Equipped with a Magnetic Chuck the machine will handle a large variety of flat work on a very economical production basis.

6 x 10 x 36" Open Side Surface Grinding Machine with Hydraulic Table Traverse. Above—Detail of work held on magnetic chuck.

NORTON
GRINDING MACHINES

NORTON COMPANY, WORCESTER, MASS.

New York Chicago Detroit Philadelphia Pittsburgh Hartford Cleveland Syracuse Hamilton, Ont. London Paris Wesseling, Germany

M-263

Mr. MODERN SAYS . . . . .

The Mult-Au-Matic makes maximum use of productive time, giving thousands of hours of profitable production at minimum operating and maintenance expense.

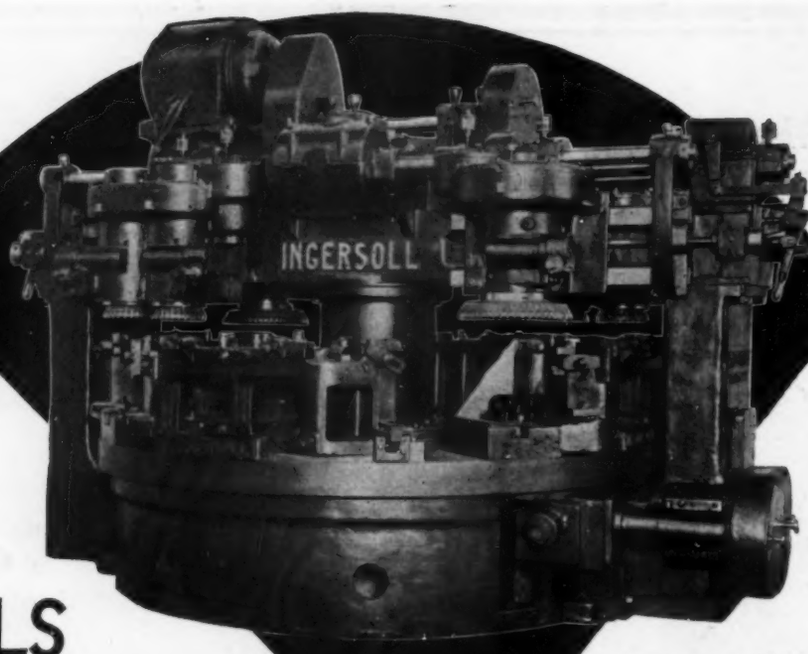
Extreme flexibility of tooling makes it universally adaptable to boring, turning and facing operations on a great variety of jobs.

The gear blanks shown are completely machined with one chucking in one minute and eighteen seconds each by the Mult-Au-Matic Method.

Let Bullard engineers show you how to cut your machining costs.

THE BULLARD COMPANY
Bridgeport Connecticut

BULLARD



108" Vertical Spindle, 2-Station Ingersoll Double Faced Fixed Rail Circular Milling Machine for rough and finish milling the top and bottom of a tractor crankcase.

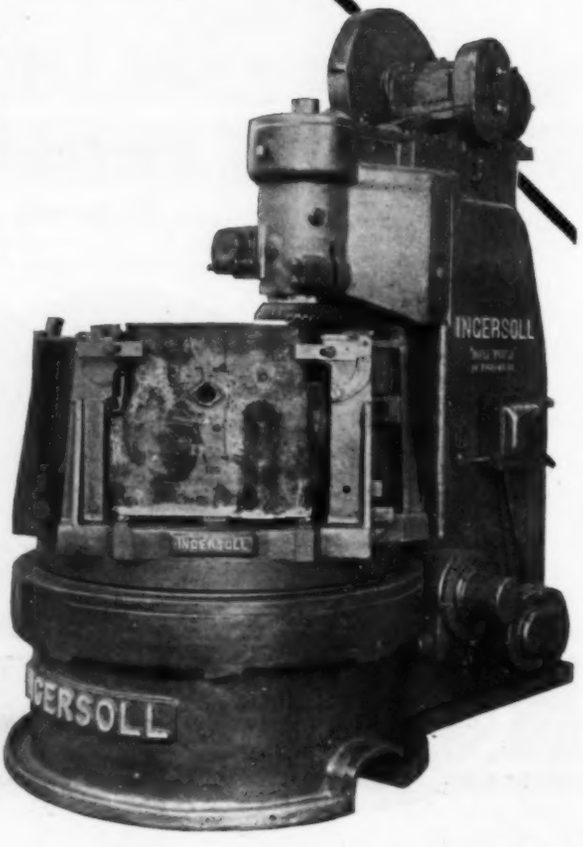
• Special INGERSOLLS for continuous production

Though the two milling machines shown here are of different types, each is designed for continuous production of duplicate parts and consists essentially of a table rotating in a horizontal plane past the cutters at a predetermined rate over which the operator has no control. As milling is continuous, no time is lost in a return stroke of the table.

In the Circular type shown above the table revolves between the housings, but in the Rotary type below it is entirely in front of the housing. Circular machines usually have several saddles and two loading stations, while Rotary types have but one or two saddles and one loading station. Change-over is effected by a change of fixtures and readjustment of spindles.

Whether for milling aluminum, iron or steel in heavy, sturdy pieces, or frail castings of light section, each is built only after a thorough study of the work it is to do. We furnish each complete with cutters and fixtures and guarantee the accuracy and output of the unit.

Write for Bulletin No. 47 describing Ingersoll Continuous machines in detail.



Ingersoll 54" Single Vertical Spindle Rotary Type Milling Machine for finish milling the top of a tractor crankcase.

THE INGERSOLL MILLING MACHINE COMPANY » » ROCKFORD ILLINOIS, U.S.A.

THE TRUTH COMES OUT

IN THIS ROOM where New Departure standards are checked and rechecked by instruments so sensitive that any deviation from perfection is magnified ten thousand times. Temperature and humidity are closely controlled — the former to within two degrees Fahrenheit — so that a hundred thousandth of an inch is just that, today, tomorrow and always. Few plants can boast of a constant temperature room and gauges deserving of such an atmosphere. This is but one of New Departure's many exceptional manufacturing facilities, one that should impress users of anti-friction bearings. Is it any wonder that New Departure Ball Bearings are first in precision, performance and preference? The New Departure Mfg. Company, Bristol, Connecticut.

1670

NEW DEPARTURE BALL BEARINGS

These jobs are a problem for any production manager

Only 1 of this

25 of these

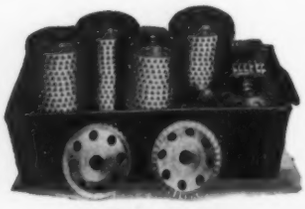
50 in this lot

25 here

because this work ordinarily requires constant tool changes

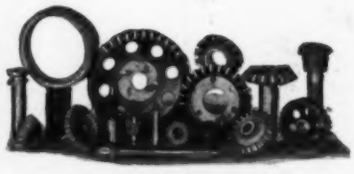
but—

The Steel Products Engineering Co., Springfield, Ohio, has eliminated the need for these tool changes by using Warner & Swasey turret lathes with standard tools.



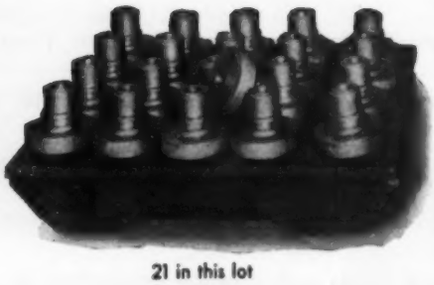
1000 in this lot

50 in this lot



300 to 1500 of these

50 of these



21 in this lot

25 in the lot

The Warner & Swasey Company

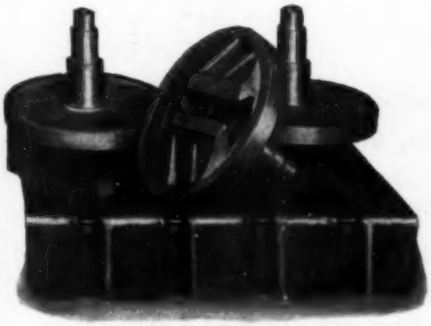
Cleveland, Ohio, U. S. A.

1880 *Entering our Fifty-first year as Builders of Turret Lathes* 1930

Production costs were cut 60%

and the savings on their new Warner & Swasey turret lathes will pay for the machines in approximately two years.

3 lots of 3, 25 and 300



Only 7 in this lot

You, too,

can eliminate constant tool changes and at the same time lower your production costs.

A Warner & Swasey engineer is ready to survey your work. He will show you what is needed to lower your production costs.

—Just call our nearest representative.

Boston
Chamber of Commerce Building

Buffalo
Iroquois Building

Chicago (Showroom)
618-622 Washington Boulevard

Dallas
805 Newell Avenue
The Warner & Swasey Sales Co.

Dayton
610 Winters Bank Building

Detroit (Showroom)
5928 Second Boulevard

Indianapolis
4602 Guilford Avenue

Los Angeles (Warehouse)
1118 Santa Fe Avenue
The Warner & Swasey Co. of Calif.

Milwaukee
1143 Wells Building

New York
Singer Building

Philadelphia
5143 Spruce Street

Pittsburgh
Chamber of Commerce Building

St. Louis
1627 Locust Street

Syracuse
108 Grant Avenue

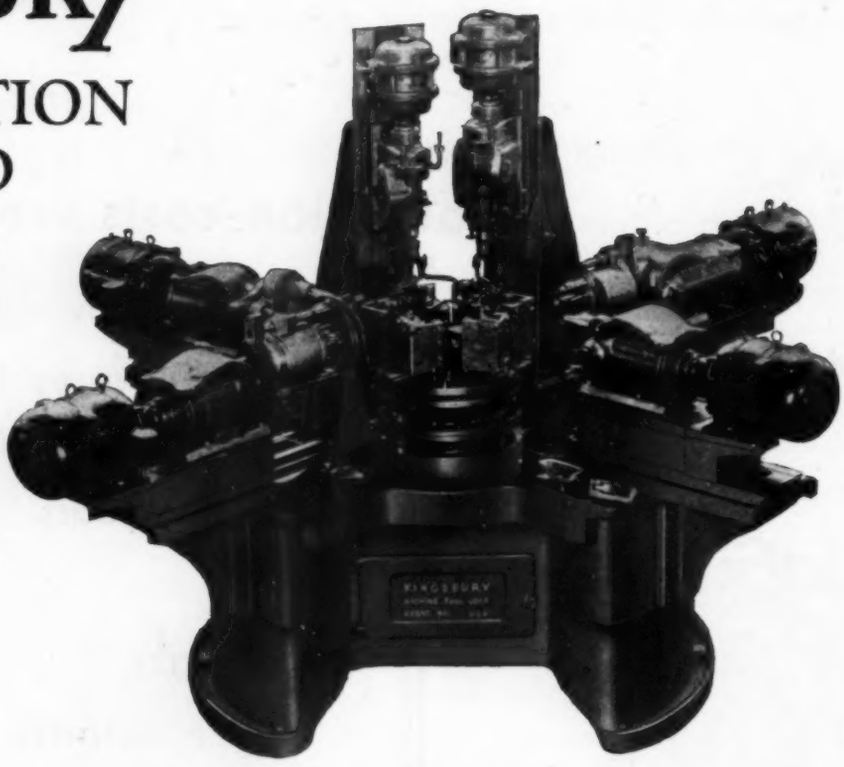
With Production an Accepted Fact— Investigate the Economy of the

KINGSBURY

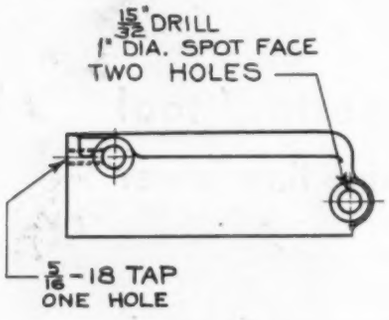
CONSTRUCTION METHOD

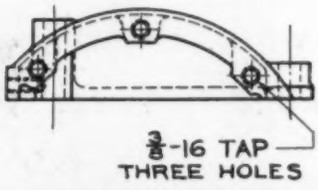
"Every machine a special machine built for the job" is a production ideal that is not as far fetched as it may seem when operations come within the scope of the Kingsbury method.

With production a foregone conclusion, it is the economy of the Kingsbury method of building special purpose automatics that makes them so attractive to the machine buyer.



"Type GH Kingsbury multi-spindle automatic indexing type drilling and tapping machine. This machine drills and taps four holes and drills two other holes from three directions, all in a single chucking of the work."





Kingsbury production units are really standard individual drilling, tapping, milling, facing, reaming and burring machines manufactured by modern production methods. These units are assembled into high efficiency special automatic machines designed by our engineers, and equipped with special fixtures, indexing tables, etc., that fit them for an amazing range of work.

AUTOMATIC DRILLING *by the* **KINGSBURY METHOD**

KINGSBURY MACHINE TOOL CORP.

KEENE NEW HAMPSHIRE

Originators of the Automatic Drilling Head Unit

NEWTON
CONTINUOUS MILLERS

For Milling
Parts Used on

AUTOMOBILES

REFRIGERATORS

REFRIGERATING MACHINERY

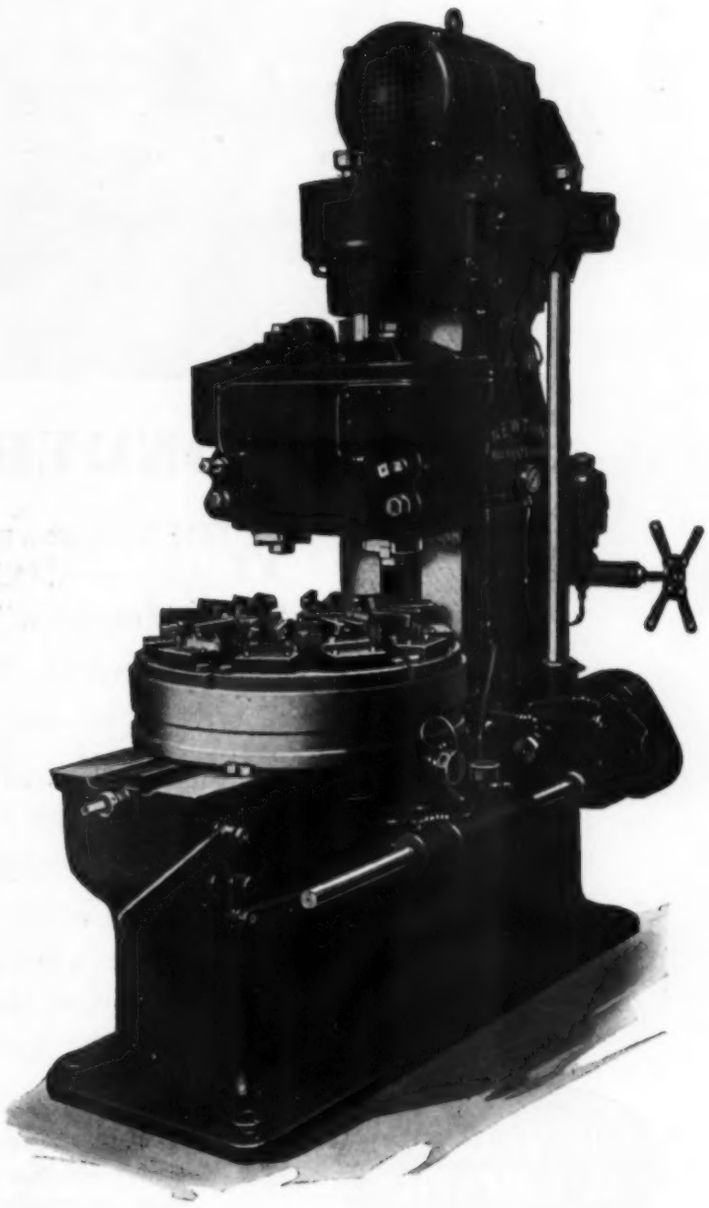
WASHING MACHINES

VACUUM CLEANERS

ELECTRICAL APPLIANCES

PUMPING MACHINERY

GASOLINE ENGINES



Possibly these comparatively low cost, high production machines can be used in manufacturing your product.

If so you are bound to produce the parts at lower costs.

One thing to remember is that while they are single purpose machines in the production line, they are adaptable to an infinite number of uses.

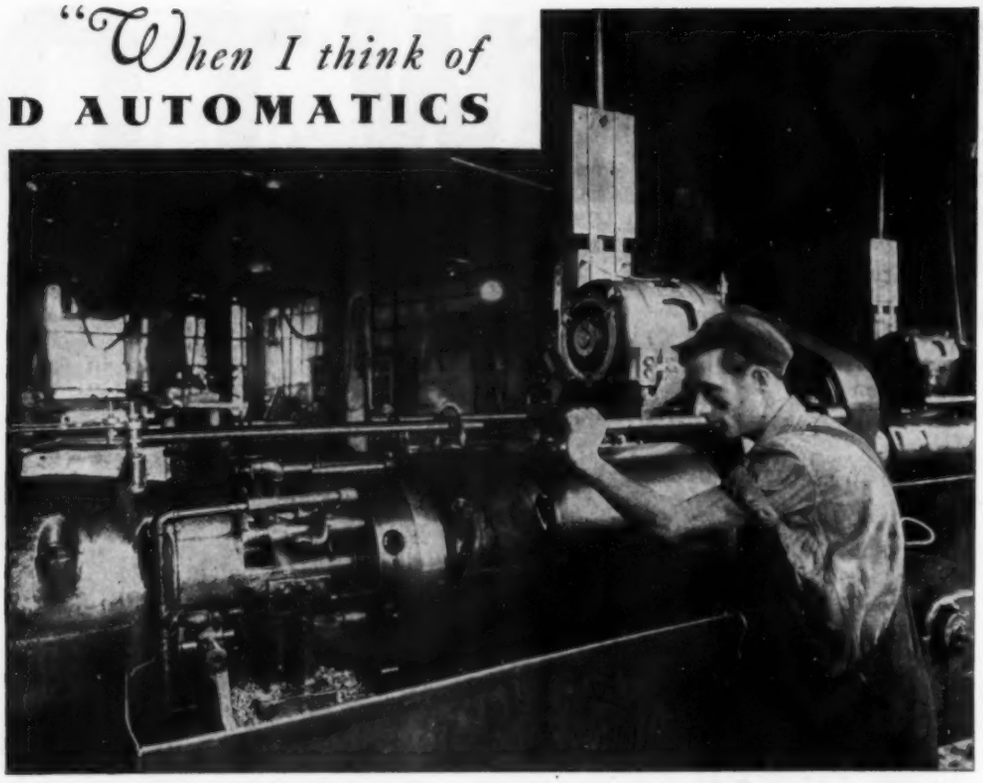
Send for more information and ask for the Automotive Catalog.

BETTS · NEWTON · COLBURN · HILLES & JONES · MODERN

CONSOLIDATED

CONSOLIDATED MACHINE TOOL CORPORATION *of* AMERICA, Rochester, N. Y.

"When I think of
CLEVELAND AUTOMATICS



I think of . . . . . WONDERFUL BEARINGS"

"WHEN I have a particular job," says a veteran machine shop man, "I like to put it on a Cleveland Automatic machine."

Most operatives like Cleveland Automatics and will enthuse about their speed, their convenience, their tooling possibilities.

But this one has still another story. "When I think of Clevelands, I think of the bearings—wonderful, smooth running, true bearings.

"Bearings are what tell the story when you have to hold a piece down to a two-thousandth tolerance or less. It's easy to tool and adjust and takes mighty little attention after it starts. And the work it turns out is certainly right."

CLEVELAND AUTOMATICS

When every piece passes inspection, it means high NET SPEED, economy, freedom from assembling troubles and a public pleased with your product. Cleveland engineers may always be consulted about your machine production problems.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

2269 Ashland Road, Cleveland, Ohio, U. S. A.

NEW YORK
95 Liberty Street

CHICAGO
565 W. Washington Boulevard

DETROIT
1217 Book Building

A Merry Christmas! And may the New Year bring you increased prosperity ~ ~ ~ ~ is the wish of the ~

UNION TWIST DRILL CO.

ATHOL, MASS.

New York Store: 62 Reade St.,
Derby Line, Vt.

San Francisco Store: 121 Second St.
Mansfield, Mass.
Representatives Throughout the World

Chicago Store: 11 So. Clinton St.
Rock Island, Quebec

Makers of All Kinds of Milling Cutters, Twist Drills, Reamers, Hobs and Threading Tools

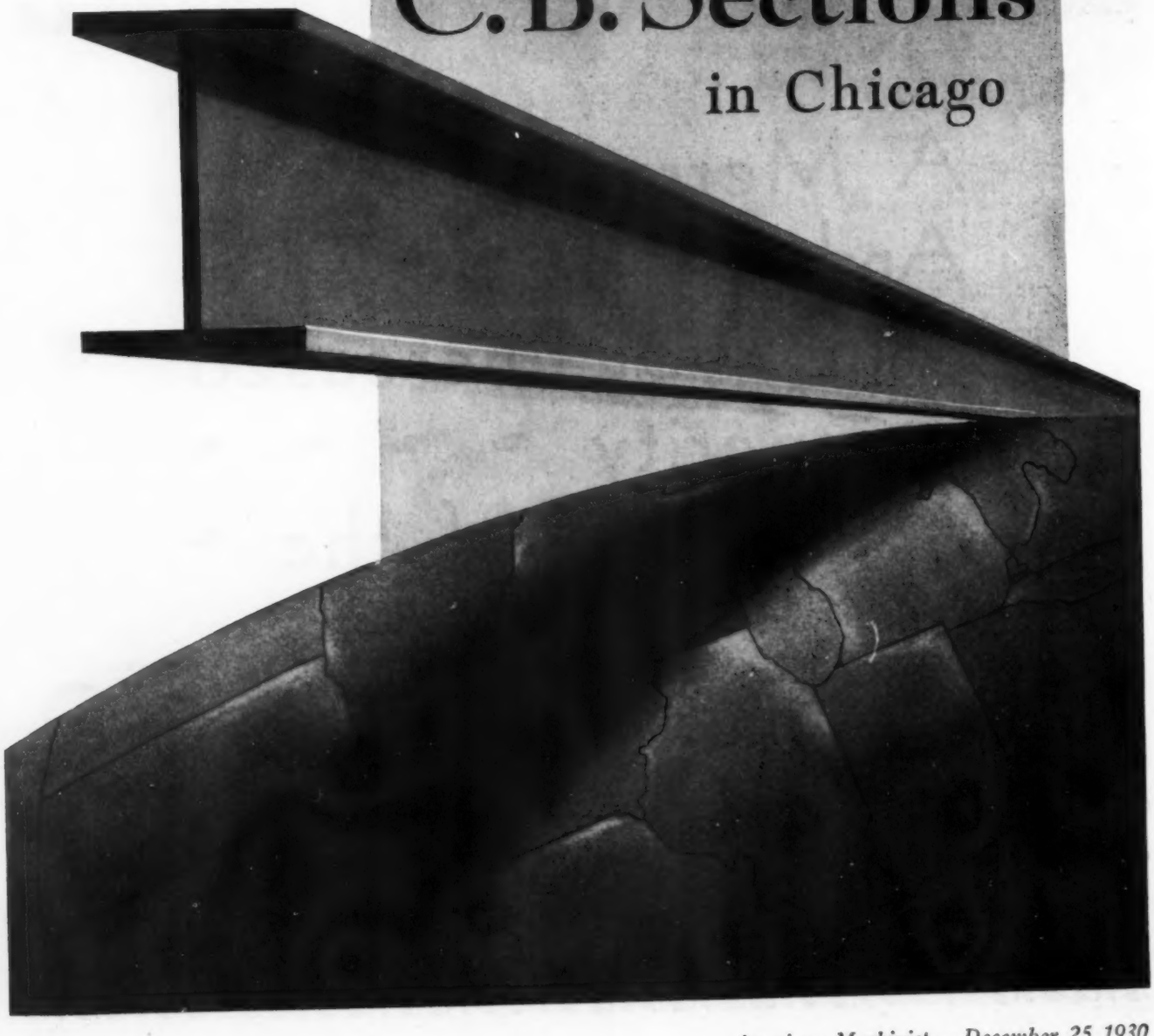
Illinois Steel Company

Subsidiary of United States Steel Corporation

soon will announce
the production of

C.B. Sections

in Chicago



HERE IS PERFORMANCE

Patented

IN NEW JERSEY

This Cincinnati No. 3 Centerless Grinder is one of eight Cincinnati Centerless in operation on bar work at the Crucible Steel Co., of America, Harrison, New Jersey.

Bars of better grade, more accurate size and more universal dependability—that's what the Crucible Steel Co , of America, Harrison, New Jersey, gets by cen e-less grinding steel bars. Centerless grinding of bars makes possible fast inspection of the soundness of the work, removal of surface defects, removal of decarbonized surface layer, maintenance of close limits of accuracy, easily meeting specifications of special sizes, and faster production than any other method of grinding.

The ever-increasing demand for high quality bars has prompted the installation of more than 100 Cincinnati Centerless Grinders among steel bar producers. The speed at which scale and black finish are removed makes the grinding of bars profitable as well as practical.

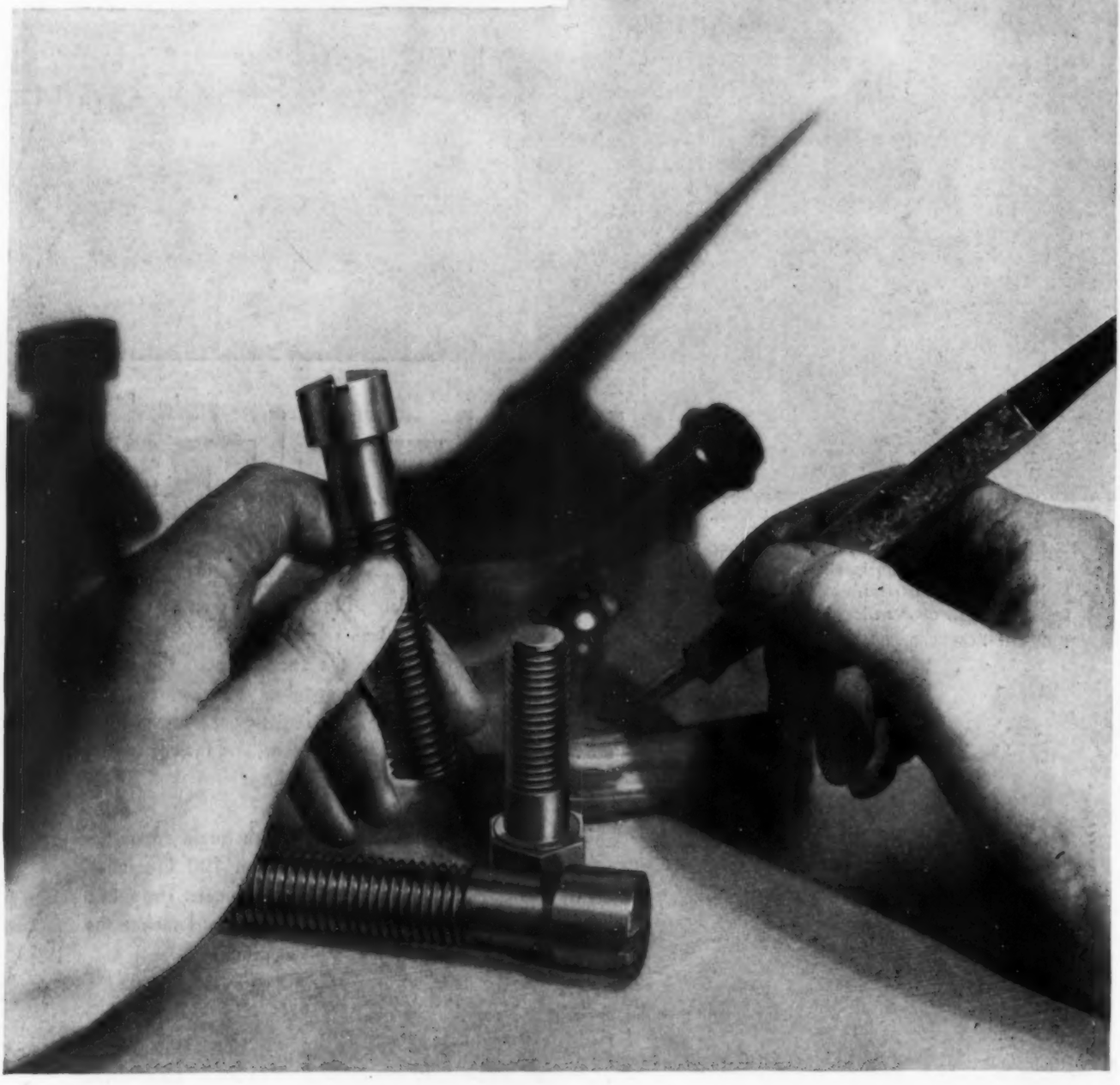
In 28 New Jersey cities including Rutherford, New Brunswick, Keyport, Elizabeth, Passaic, Camden, Trenton, Arlington, Jersey City, Plainfield, Bridgeton, Weehawken, Paterson, Newark, and 14 others, Cincinnati Centerless and Centertype Grinders are giving manufacturers accurate, economical results. Get additional performance facts on Cincinnati Grinders by seeing one in operation.

CINCINNATI

Cincinnati Grinders Incorporated

Cincinnati, Ohio, U. S. A.

Specified by name by many large users



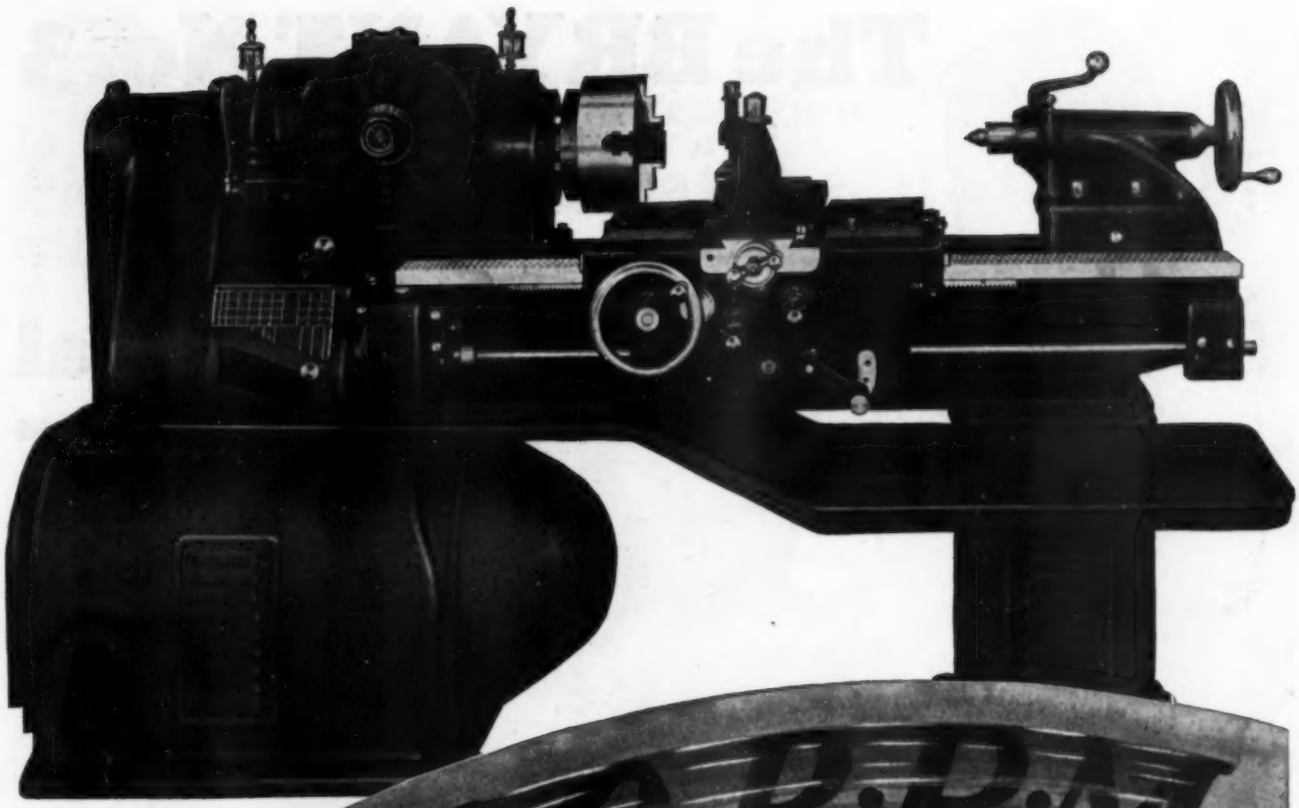
THE more accurate the cap screw thread, the more accurate the fit in the tapped hole. This premise causes a number of production men to specify Cleveland Cap Screws. They know from experience that a Cleveland Cap Screw, made by the Kaufman Method, *patented,* affords a far better fit than is ordinarily expected. A Class 3 fit is our standard production in this plant. Tests on your production line will prove it is a better cap screw from every point of view.

THE CLEVELAND CAP SCREW COMPANY
2938 E. 79th St., Cleveland, Ohio

Address the Nearest Company Warehouse—Complete stocks at

CHICAGO, 726 W. Washington Blvd.
DETROIT. . 520 W. Congress Street
PHILADELPHIA . 12th & Olive Sts.
SAN FRANCISCO . 548 Howard St.
NEW YORK . . . . 47 Murray Street
LOS ANGELES . . . 224 E. 11 Street

CLEVELAND CAP SCREWS



4400 R.P.M.

The Highest Lathe Speed Ever Attained!

THE NEW Monarch SUPER High-Speed Lathe . . . with spindle speeds up to 4400 R. P. M. . . . marks a new epoch in lathe practice. It makes the use of tungsten-carbide turning tools both practical and economical.

Speed, economy and high production records, which a few months ago seemed impossible, are now every-day occurrences. A glance through record sheets of this lathe's performance . . . in comparison with those of an ordinary high-grade lathe using high-speed steel turning tools . . . reveals facts like these:

Ordinary lathe time, per piece, 8.9 min.
Monarch Super High Speed time 0.7 min.

Ordinary lathe time, per piece, 19.1 min.
Monarch Super High-Speed time 2.0 min.

Ordinary lathe time, per piece, 3.0 min.
Monarch Super High-Speed time 0.5 min.

The combination of a perfectly Timkenized spindle and an anti-friction tailstock center that will stand up to terrific speeds—together with extreme rigidity and weight—make these records possible.

Bulletin 146 gives you FACTS, FIGURES, PROOF! Write today for your copy.

THE MONARCH MACHINE TOOL CO., Sidney, Ohio, U.S.A.

New York Sales Office, 857 Graybar Building

Monarch lathes

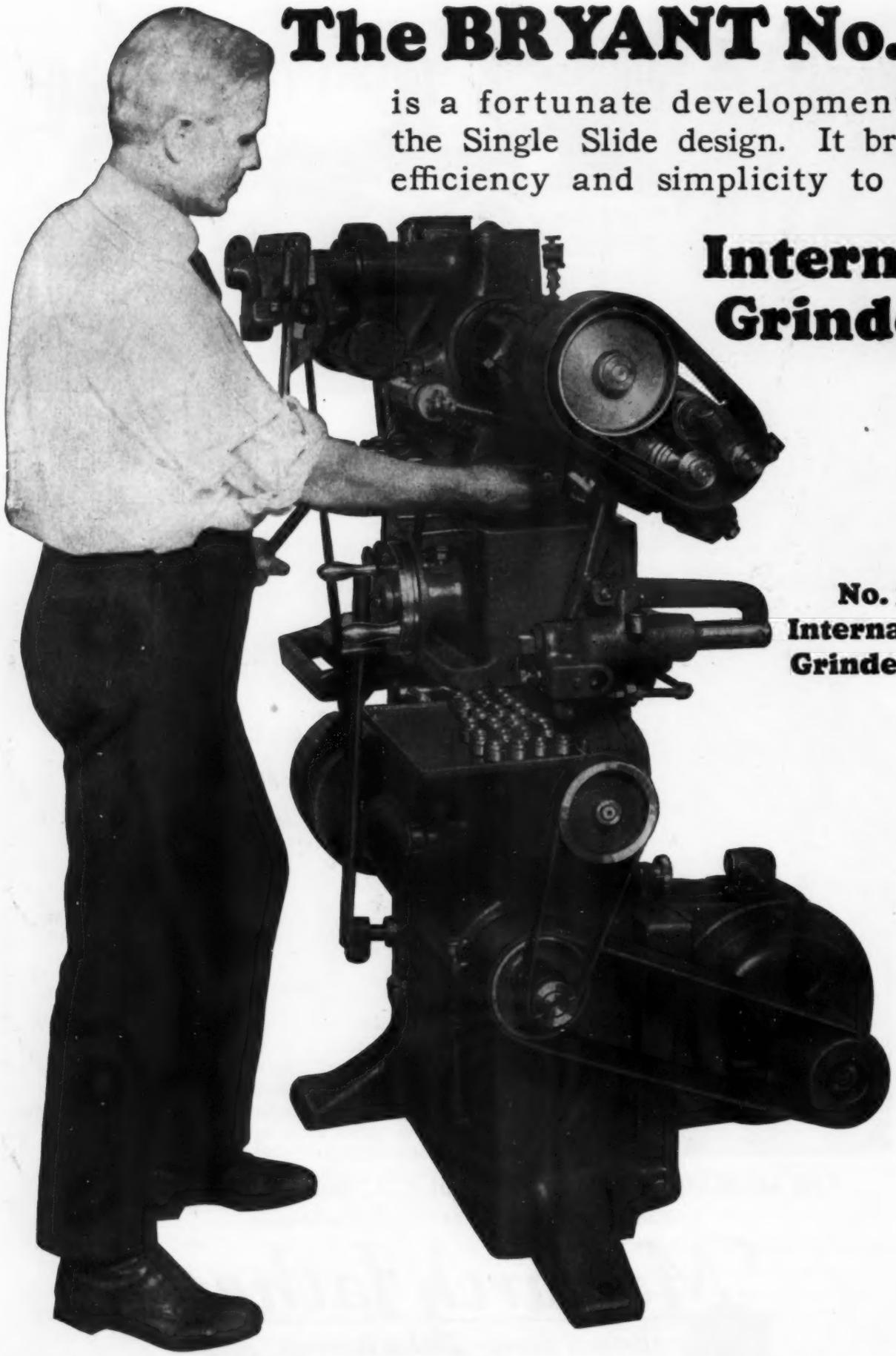
Helical Gears - Timken Bearings

SMOOTHER..QUIETER..MORE POWERFUL

The BRYANT No. 3

is a fortunate development of the Single Slide design. It brings efficiency and simplicity to the

Internal Grinder



No. 3 Internal Grinder

BRYANT CHUCKING GRINDER CO., Springfield, Vermont, U. S. A.

Above all, pressure and float switches must be dependable

C-H Enclosed Float Switches for A. C. or D. C. Service
(Bulletin 10036)

1. Used as automatic starter on small motors, as pilot switch to starter on larger motors.
2. Quick make and quick break reduce arcing and prolong life of contacts. Cam and roller type, maintaining constant pressure until switch opens. Heavy contacts to withstand severe service.
3. Standard C-H finger construction designed for long life, requiring min'mum care. Easily renewable.
4. Switch easily changed for tank or pump operation.
5. Cast iron enclosing safety case, dust- and splashproof. Conduit holes provided at top. Interior made easily accessible for test, inspection and adjustment by removing 4 screws from cover.
6. All parts conform to C-H Standard of ruggedness.

PRESSURE and float switches often take the place of human watchers; sometimes they are entrusted with the responsibility for vital production operations; since they "control the control" they should match the rest of the electrical equipment in dependability and efficiency of operation. Otherwise you are exposing production to needless delay, loss and expense.

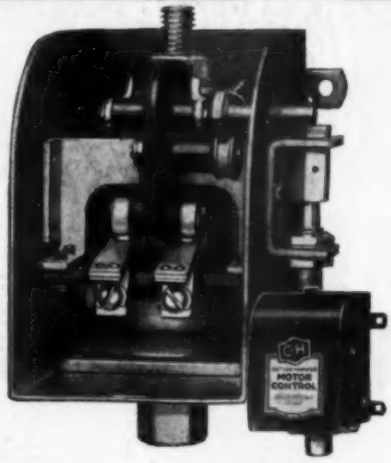
Cutler-Hammer pressure and float switches have kept pace with Cutler-Hammer Motor Control in their development. You will find in them the same advanced design, the same high-grade workmanship, the same exacting standards of performance.

Those shown on this page are illustrative of the entire comprehensive line, of the compactness and correctness of design of C-H pressure switches in general. Complete information as to these or switches for any purpose you may have in mind will be sent upon request.

CUTLER-HAMMER, Inc.
Pioneer Manufacturers of Electric Control Apparatus
1212 St. Paul Avenue
MILWAUKEE, WISCONSIN

C-H Enclosed Pressure Regulator for A. C. or D. C. Service
(Bulletin 10014)

1. Stationary contacts are adjustable with calibrated scale to give any desired operating pressure.
2. Bourdon tube actuates visible indicating needle—also actuates swinging contact arm which in turn controls motor-operation.
3. Long operating life assured by having swinging arm handle only pilot circuit of relay while relay handles pilot circuit of motor starter.
4. Gauge type for vacuum, pressure or hydraulic applications.
5. Full automatic operation. Easy installation.
6. Accurate adjustment—uniform operation.
7. For either standard or reverse operation.
8. Both swinging arm and relay have silver contacts which insure good contacts under all conditions.
9. Sturdy dustproof safety enclosing case provided with conduit knockouts at sides and bottom. Threaded pipe connection to Bourdon tube.
10. Standard C-H sturdy and simple construction.



New C-H Pressure Switch
(Bulletin 10006)

Quick *double* break, and make, sturdy simple construction add dependability to pumping and compressor equipment.

1. *Double*-break contacts reduce arcing. Silver tips increase current-carrying capacity. Long life assured regardless of frequency of operation.
2. Two connections complete the wiring. Ample wiring space. Knockouts provided for conduit or armored cable wiring.
3. Rubber diaphragm and tension spring control switching mechanism without strain. Minimum moving parts, simple design, assure uniform, long-life operation.
4. Unloader—for air compressor service. Automatic movement releases valve and unloads back pressure from compressor, making starting of motor easy.
5. Sturdy, black japanned enclosing case. All metal parts cadmium plated and corrosion-proof. One hand-screw allows removal of cover, for adjustment or inspection.

CUTLER HAMMER

The Control Equipment Good Electric Motors Deserve

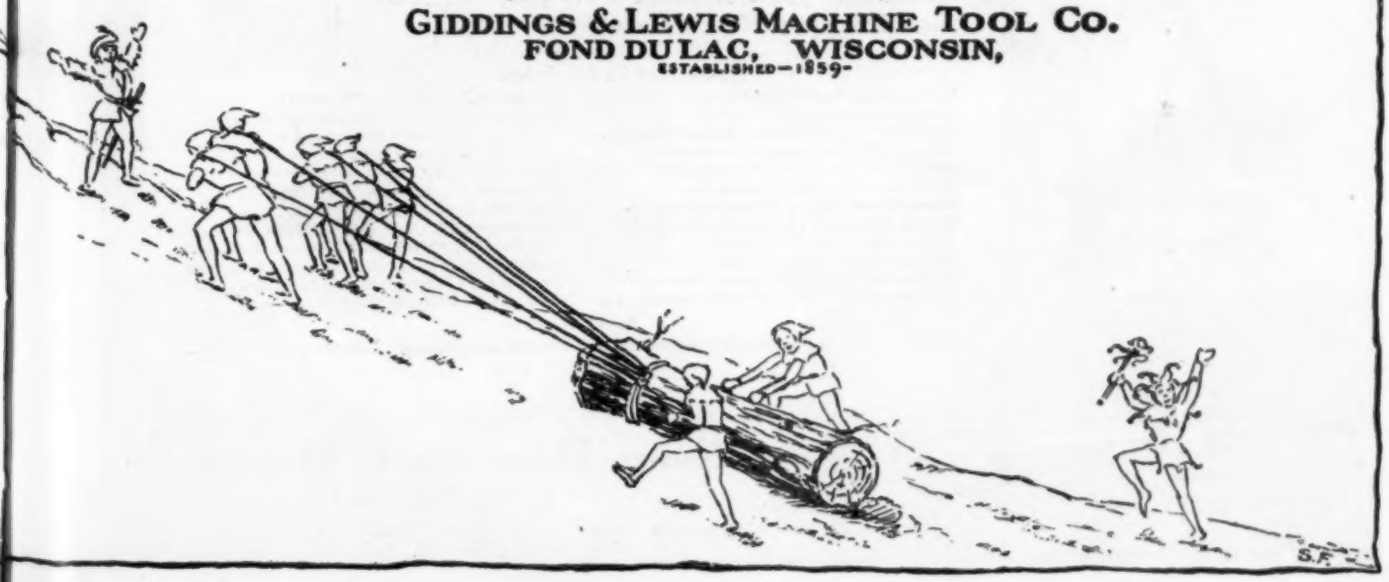
(A-287)

We'll put a pretty picture,
A message, too, in rhyme,
Don't mention Methods in the ad
Forget production time.

Just wish you Merry Christmas, and
A Happy, Prosperous year;
That is the thought we have in mind
— It really is sincere.

Specialists in Horizontal Boring, Drilling and Milling

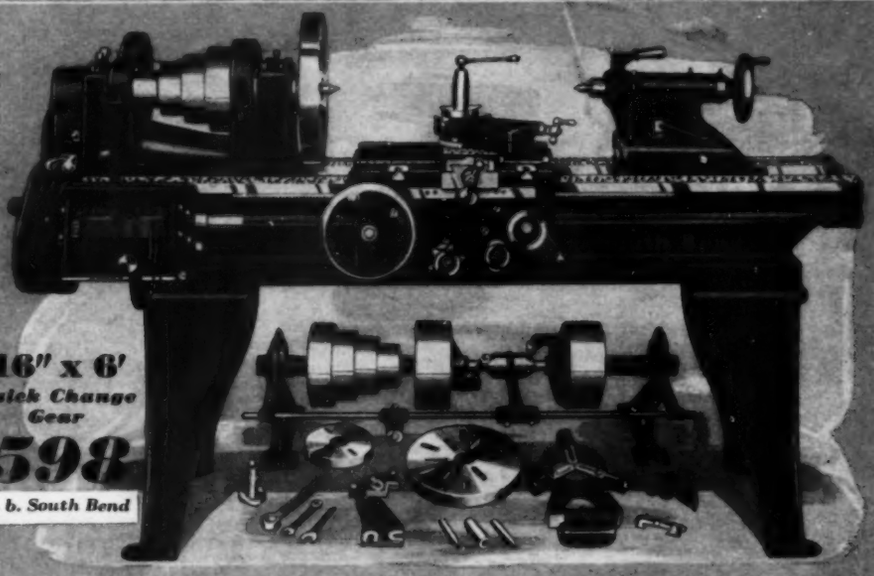
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN,
ESTABLISHED—1859—



NEW MODEL SOUTH BEND LATHES

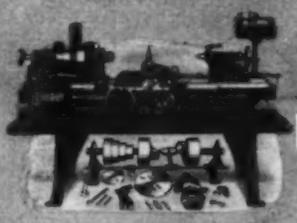
Back Geared, Screw Cutting
PRECISION LATHES
for use in

Manufacturing Plants
Tool Rooms
Machine Shops
General Repair Shops
Marine Shops



16" x 6'
Quick Change Gear
$598
f. o. b. South Bend

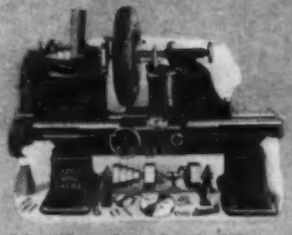
Countershaft and lathe equipment included in price



16" x 6' New Model Tool Room Lathe with Tool Room Equipment **$842**

9" x 3' New Model Junior Bench Lathe with Countershaft and Equipment . . . **$169**

18" x 8' Silent Chain Motor Driven Quick Change Gear Lathe with Motor . **$1049**



36"x6' Large Swing Standard Change Gear Lathe with Countershaft and Equipment . . **$688**

More than 48,000 Users in 78 Countries

The New Model South Bend Lathe is overwhelmingly popular because of its high quality and moderate price, both the result of 24 years' experience in lathe building. It is used by leaders of every industry, including:

American Tel. and Tel. Co.	*New York Central R. R. Co.*
General Electric Company	*Olympic Steamship Company*
General Motors Corporation	*Pratt and Whitney Aircraft Co.*
International Harvester Co.	*Radio Corp. of America*
National Cash Register Co.	*Westinghouse Elec. & Mfg. Co.*

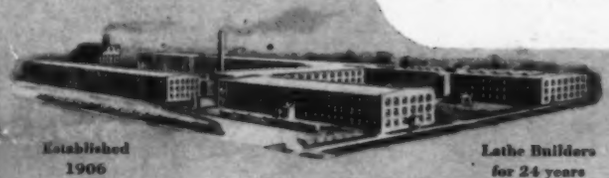
The New Model South Bend Lathe is built in 96 sizes from 9" to 18" swing and 3' to 12' bed length. It is supplied with countershaft or motor drive, in a style for every purpose. Send for a free copy of New Catalog No. 91-A.

Carried in Stock by:

Boston, Mass.: Lynd-Farquhar Co.
Bridgeport, Conn.: A. C. Bisgood
Buffalo, N. Y.: J. L. Osgood Mchy. & Tool Co.
Chicago, Ill.: C. B. Burns Machinery Co.
Cincinnati, Ohio: The E. A. Kinsey Co.
Cleveland, Ohio: Hess-Schenck Co.
Dallas, Texas: Huey & Philp Hardware Co.
Dayton, Ohio: C. H. Gosiger Machinery Co.
Detroit, Mich.: Lee Machinery Co.
Houston, Texas: Peden Company
Kansas City, Mo.: H. J. Brunner Hardware Co.
Los Angeles, Calif.: Eccles & Davies Mchy. Co.
Milwaukee, Wis.: Badger-Packard Co.
Minneapolis, Minn.: F. E. Satterlee Co.
Newark, N. J.: Cassell Machinery Co.
New York City: A. C. Colby Machinery Co.
Philadelphia, Pa.: Delta Equipment Co.
Pittsburgh, Pa.: Reliance Mchy. Sales Co.
Plainville, Conn.: Ideal Mchy. Co.
Providence, R. I.: Brownell Machinery Co.
San Francisco, Calif.: Herberts-Moore Mchy. Co.
Seattle, Wash.: West Coast Mchy. Co., Inc.
St. Louis, Mo.: Colcord-Wright Mchy. Co.
Syracuse, N. Y.: H. A. Smith Mchy. Co.

In Canada:

Montreal, Quebec: Canadian Fairbanks-Morse
Toronto, Ontario: A. R. Williams Mchy. Co.



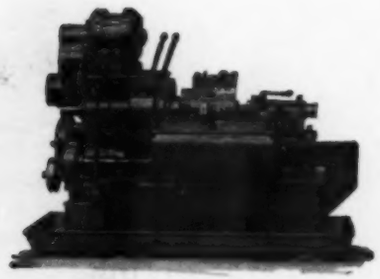
Established 1906

Lathe Builders for 24 years

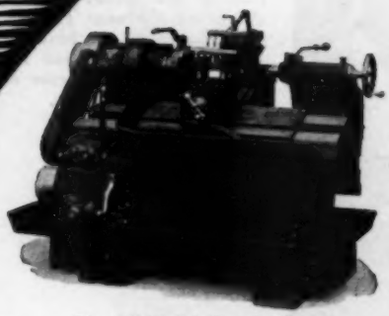
South Bend Lathe Works

199 East Madison Street
South Bend, Indiana, U. S. A.

Tool Room Grinder

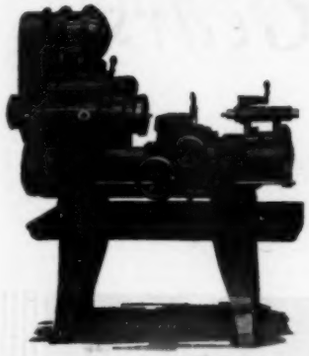


No. 12 Automatic Lathe



No. 12 Multi Cut Lathe

THE NAME LEBLOND



11 in. Rapid Production Lathe

LE BLOND

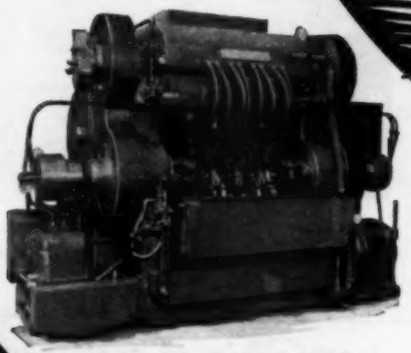
A mark of QUALITY—

Backed by forty years' experience in machine tool design and construction.

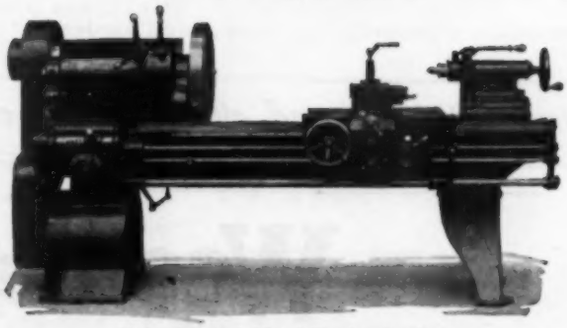
A mark of PROGRESS—

The development of LeBlond machine tools is reflected throughout the industry in increased production; the basic economic factor of American success.

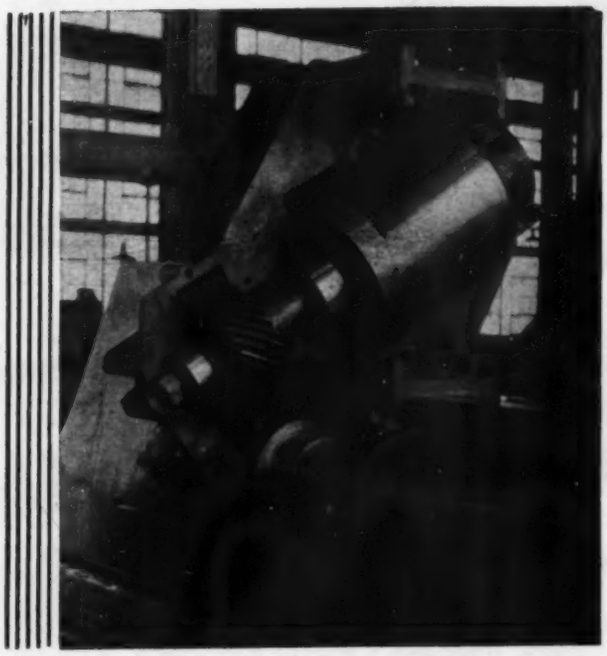
The R. K. LeBlond Machine Tool Co.
CINCINNATI OHIO U. S. A.



5 AC Pin Bearing Crankshaft Lathe



19 in. Geared Head Engine Lathe



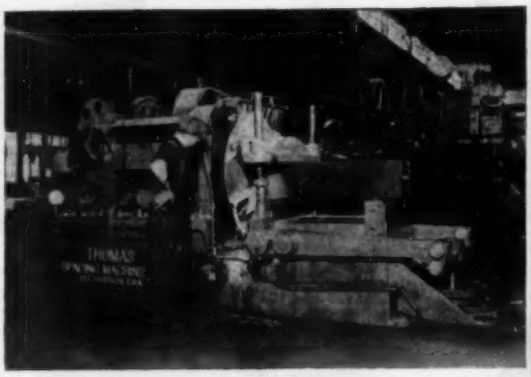
One of the spiral gear roll drives on the new Treadwell Straightening Machine (Abramsen Design), said to be the largest machine ever built for this purpose.

SMOOTHER OPERATION *with Helical and Spiral Gears*

RECENT outstanding developments in metal working machinery by the Treadwell Engineering Company and the Thomas Spacing Company have resulted in producing smoother work than was possible with former equipment.

This improvement, according to the builders, has been attained principally because spiral and helical gears are used at vital points. These are Westinghouse-Nuttall gears, bearing out what many manufacturers have learned —that gears made by Westinghouse-Nuttall facilities always measure up to the highest standards.

Westinghouse-Nuttall spur, helical, herringbone, bevel, spiral and worm gears are made in sizes ranging from one inch to 30 feet in diameter, and when the service demands, are properly heat-treated and hardened.



With helical gears in the final drive, this new Thomas Column Facing Machine, the largest ever built, leaves no chatter marks on the finished surfaces.

Service, prompt and efficient, by a coast-to-coast chain of well-equipped shops

Westinghouse

T 31641

TUNE IN THE WESTINGHOUSE SALUTE OVER THE N. B. C. NATION-WIDE NETWORK EVERY TUESDAY EVENING.

"Special Hanson-Process Taps are an important part of our service to industry"

Threading problems are so diversified that "special" Taps always will be needed to some extent.

To meet these conditions more fully, and to render a complete service to our customers, we have set aside a portion of our manufacturing facilities for the making of special Taps.

The same close adherence to precision limits of .0001 in. in lead is maintained.

In ordering, kindly give details of thread form and pitch, also lead if multiple, outside diameter, pitch diameter, also specify tolerance limits desired.

Include shank diameter and length, also size of square if desired.

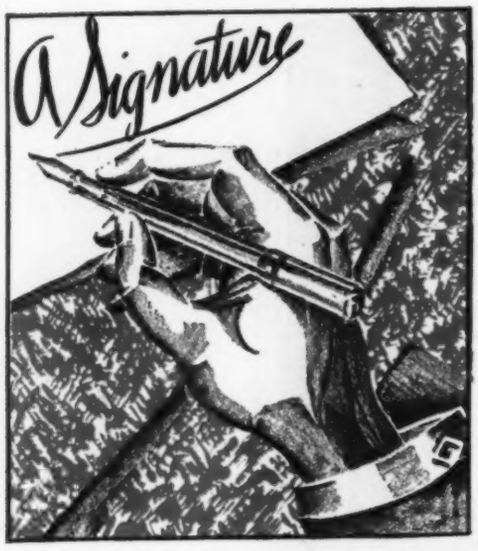
Advise nature of material to be tapped. State whether hole is blind or extends through nut, whether tap is reversed in withdrawing, or can be removed after passing through work and if provision is made for lubricating tap freely.

Prices and delivery cheerfully quoted upon receipt of specifications.

"HANSON" H PROCESS

The Hanson-Whitney Machine Company

Hartford, Conn., U.S.A.



may be FORGED

THERE are men in the world who can reproduce your signature so accurately that you yourself would think it genuine. What if one of them some day forges your signature on a document which will obligate you—possibly ruin you? Perhaps you could get out of it—perhaps not.

But this forger cannot reproduce your fingerprint! All you need do is sign your name and place your fingerprint over your signature. No forger in the world can duplicate that. And if your fingerprints are recorded, that signature stands as legal evidence for all time. Your signature is identified positively even though your actual person were a thousand miles away.

The day is coming when all legal documents will not only be signed but *fingerprinted.* A few farsighted banking institutions are doing it today. They have divorced the idea of fingerprints from crime, and have recognized those prints as a valuable *business* identification. Here and there individuals are realizing the same thing. They are recording the fingerprints of their families, and are using their thumbprints over every signature they write.

Why not do this yourself? You have everything to gain by it. Your own fingerprints are your very best legal protection.

ROBERT T. HURLEY
Commissioner
Connecticut State Police

P & W
HOKE GAGES

For Gaging Gages

Somewhere, in every metal working plant, there must be a source of accuracy—something as certain, as authentic, as unchallenged for its accuracy as a fingerprint is of identity.

The plant that depends upon hand micrometers or other equally uncertain standards cannot compete in accuracy with a modern shop equipped with Hoke Gages that are accurate to millionths.

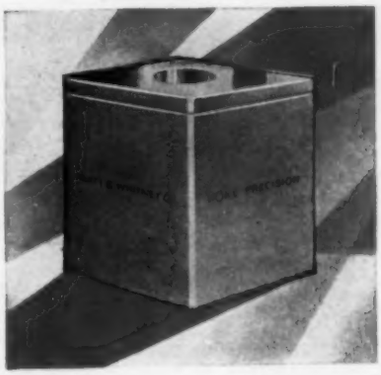
With Hoke Gages, you can set your micrometers and gages and know you have transferred millionth accuracy into practical shop usage.

PRATT &

But . . .

your signature plus your fingerprint CANNOT be forged

Be equally sure of the gages that govern your products



THE dimension engraved on a Hoke Gage bearing the Pratt & Whitney name is positively accurate to millionths of an inch. Men who work to thousandths or "tenths" feel a great confidence when Hoke Gage accuracy protects them. Hoke Gages put the accuracy of micrometers and gages beyond all question so that the mechanic knows he is working with an indisputable standard of measurement which agrees with the finest standards of all other shops and of the U. S. Bureau of Standards.

Pratt & Whitney Hoke Blocks are a thoroughly American product developed as a result of the World War. They are made by an interesting lapping process which produces actual millionth accuracy. This process and the method of seasoning the steel, to retain the accuracy, have been made practical on a commercial scale by Pratt & Whitney. The result has been that millionth accuracy is now brought into the shop as well as the laboratory, at toolroom prices.

We have an interesting booklet which describes the many uses of Hoke Blocks. In it is a description of their manufacture, and some valuable facts concerning the application of millionth precision to modern industry. A letter will bring it to you by return mail.

PRATT & WHITNEY CO., *Hartford, Conn.*

Sales Offices and Stocks at

BIRMINGHAM	CHICAGO	DETROIT	PHILADELPHIA	SAN FRANCISCO
BOSTON	CINCINNATI	LOS ANGELES	PITTSBURGH	ST. LOUIS
	CLEVELAND	NEW YORK	ROCHESTER	

WHITNEY

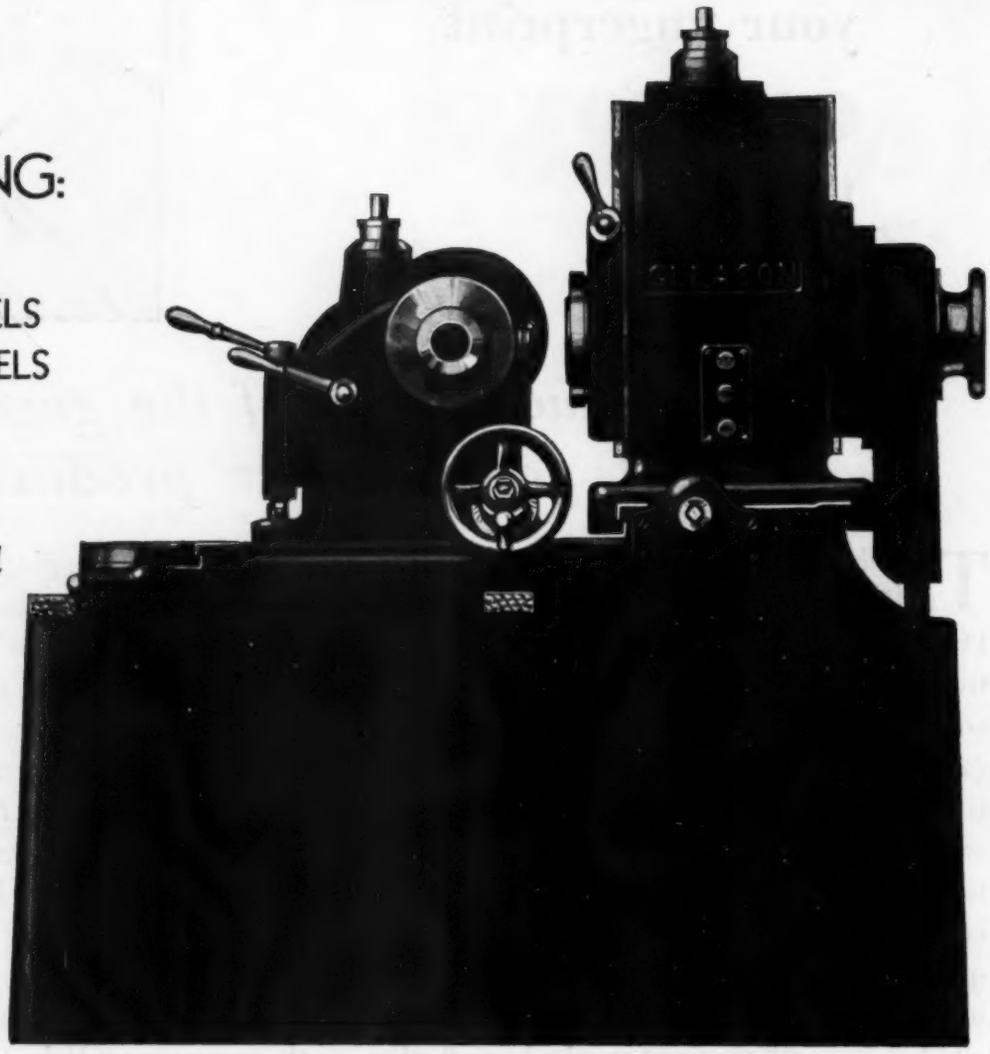
NEW! A UNIVERSAL GEAR TESTING MACHINE

FOR TESTING:

SPIRAL BEVELS
STRAIGHT BEVELS
ANGULAR BEVELS
SKEW BEVELS
HYPOIDS

Can also be used for Testing

HERRINGBONES
SPURS
INTERNAL SPURS
HELICALS
ANGULAR HELICALS



The No. 13 Universal Gear Testing Machine

THIS new Universal Gleason Testing Machine was designed to test the running qualities of all kinds of gears up to approximately 13" outside diameter. A manually operated brake is provided to test gears under load if desired.

The drive spindle has two adjustments, one vertically and one horizontally. The driven spindle has an angular adjustment from 0° to 180°, and adjustments in the horizontal plane. Full information is available.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Sixty Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

On and off 720 times an hour for 18 months—Nickel Chromium Steel clutches "stand up perfectly"

Every five seconds...720 times an hour...17,280 times a day...Columbia clutches were subjected to the heavy wear and shock of underfeed stoker service. During 18 months of tremendous loads, exposed to the constant stress of alternate starting and stopping, these Nickel Chromium Steel clutches operated without attention...without appreciable wear. • The Columbia Industrial Machinery Company knows that it pays to use Nickel Chromium Steel for parts of both intermittent-motion and interrupting type clutches...knows that it pays in better performance, better satisfaction, longer service. "With this steel", the Company states, "the clutch stands up perfectly." • Nickel Alloy Steels are helping solve difficult engineering problems the world over. Why not ask our engineers to discuss your problems with you?

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York, N. Y.

Nickel
ALLOY STEEL
PERFORMS BETTER LONGER

Intermittent-motion clutch with drum, central gear and cam gears of S. A. E. 3250 Nickel Chromium Steel, mfd. by COLUMBIA INDUSTRIAL MACHINERY COMPANY, Chicago, Ill.

The De Laval Chip Extractor ...*has everything*

De Laval Chip Extractors are built in 20-in., 26-in., 40-in. and 48-in. sizes. Thus the needs of every plant can be met in a way that is most economical both as to first cost and operating expense. Types for belt or direct motor drive.

Here is a machine which effectually ends the waste of cutting oil that is eating into the profits of many plants . . . reduces the cost of centrifuging chips . . . eliminates the fire hazard of an oil soaked chip pile.

Operated in connection with suitable De Laval Oil Purifiers, it will come close to eliminating expense for new cutting oil. For practically no oil need be lost in extraction, and constant purification of the recovered oil maintains its efficiency and enables it to be kept in service indefinitely.

That is the modern De Laval way of providing better tool lubrication at lower cost.

The De Laval Chip Extractor has many mechanical features which will appeal to you . . . features which make it the most economical extractor to own and operate that you have ever been able to secure.

Write today for full details of the De Laval Extractor and De Laval Cutting Oil Reclamation and Purification Systems in Bulletin 101-A.

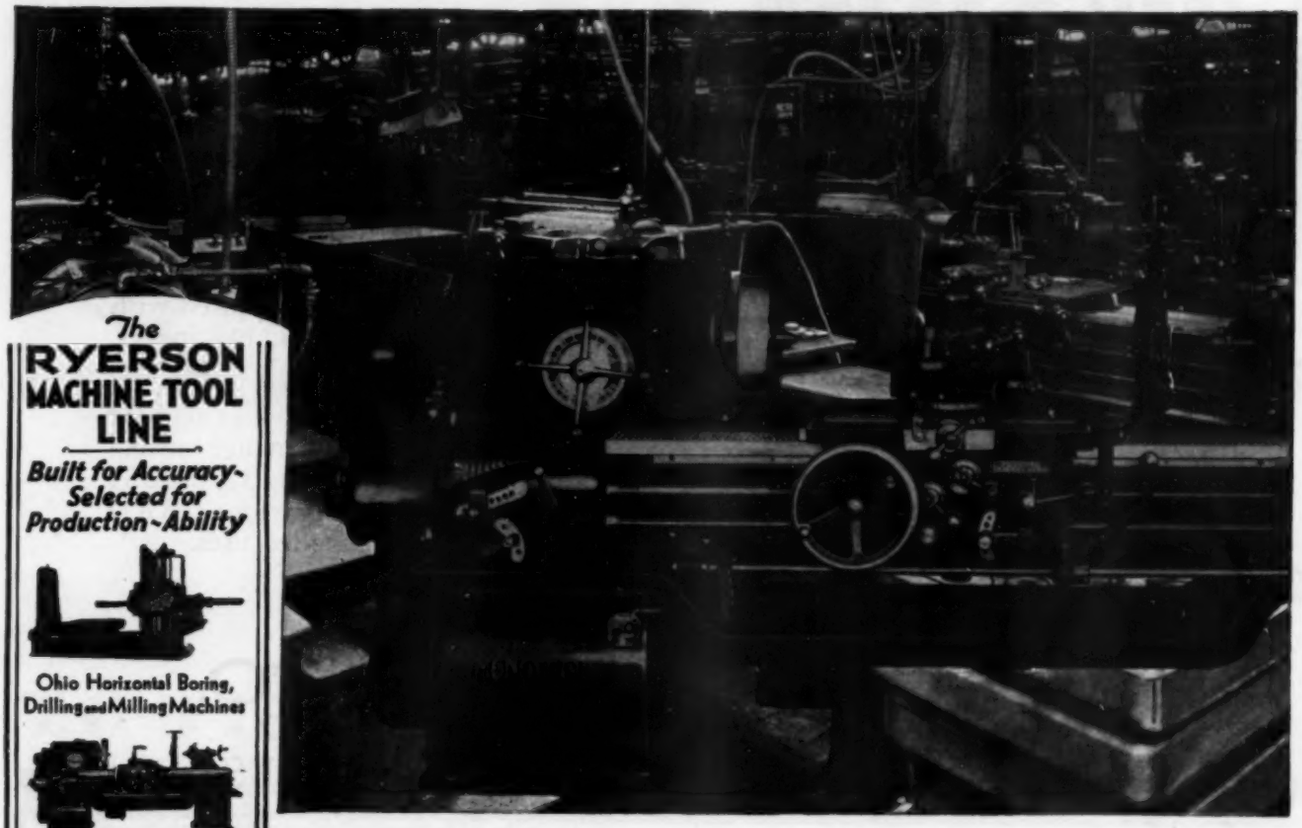
THE DE LAVAL SEPARATOR COMPANY

165 Broadway, New York -:- 600 Jackson Blvd., Chicago

DE LAVAL PACIFIC COMPANY, 61 Beale Street, San Francisco
THE DE LAVAL COMPANY, Ltd., Peterborough and Winnipeg, Canada
ALFA-LAVAL CO., Ltd., 34 Grosvenor Road, London, S. W. 1

DE LAVAL Centrifugal Systems

They Bought 27 Monotrol Lathes



The RYERSON MACHINE TOOL LINE

Built for Accuracy-Selected for Production-Ability

Ohio Horizontal Boring, Drilling and Milling Machines

Monotrol and Tritrol Lathes

Dreses Radial Drills

Ohio Shapers and Planers

RYERSON
Machinery Division
General Distributors
Machine Tools

Structural and Plate Working Equipment, Sheet Metal Tools —Welders, Railroad Shop Machinery, Small Tools, etc.

—the Lathe with the Herringbone Geared Headstock

The Spicer Manufacturing Corporation now have 27 Monotrol Lathes in their plant at Toledo, Ohio. Lathes that are handling a variety of work, maintaining a high rate of production and meeting some unusually close standards of accuracy.

The Monotrol Herringbone geared headstock gives a silent, smooth running flow of power, with complete freedom from chatter or tool marks. The exclusive one lever control on the front of the headstock enables the operator to obtain the required spindle speed without moving and without diverting attention from the work. —And he saves two-thirds the time usually taken in making spindle speed changes.

Timken precision Roller Bearings assure smooth, quiet spindle motion regardless of speed or feed.

Let us give you complete information on the instantaneous snap lever apron control—the one-piece steel alloy bed and vees, and other Monotrol features.

Write for Monotrol Lathe Bulletins.

THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO

Monotrol Lathes

General Distributors

Joseph T. Ryerson & Son, Inc.

Offices in Chicago and other principal cities

SOLD THROUGH EXCLUSIVE DEALERS

STUB STYLE Machine Screw Taps for Tapping Thin Metals

When you want a better, lower-cost tapping job than is possible with ordinary machine screw taps try these CARD Stub Taps. Performance records show longer life, faster speeds, less breakage and greater production.

They are made of alloy steel, with cut thread. Supplied with shanks plain round or squared. Length overall, 1¾ inches, with threads shortened in proportion to the length of the tap.

Spiral Pointed Stub

Put these taps to work on a tough job, alongside your regular machine screw taps—you'll find their performance strong proof of what we've said about them. See Catalog 32, page 34 for sizes and list prices. Write for folder on various CARD designs of machine screw taps, and recommended uses.

Three Fluted Stub

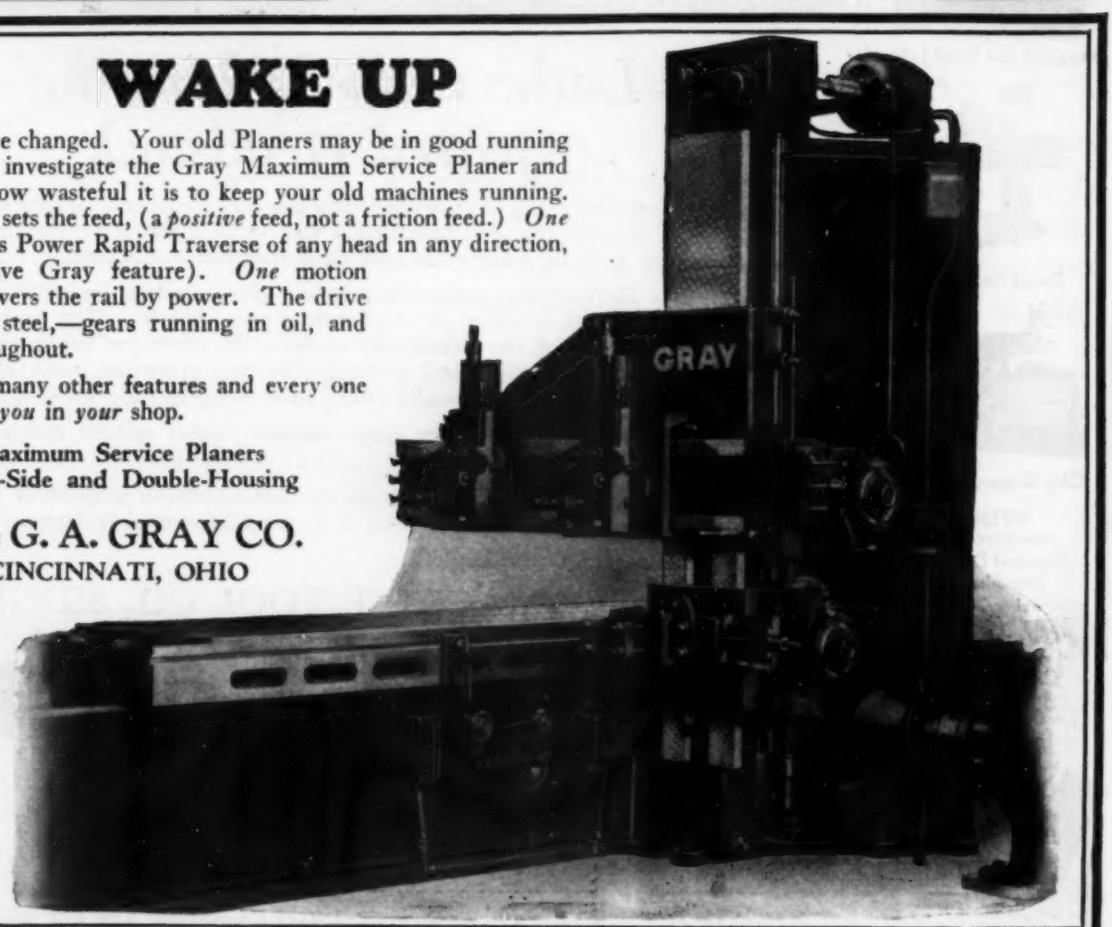
S. W. CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS, U.S.A.

WAKE UP

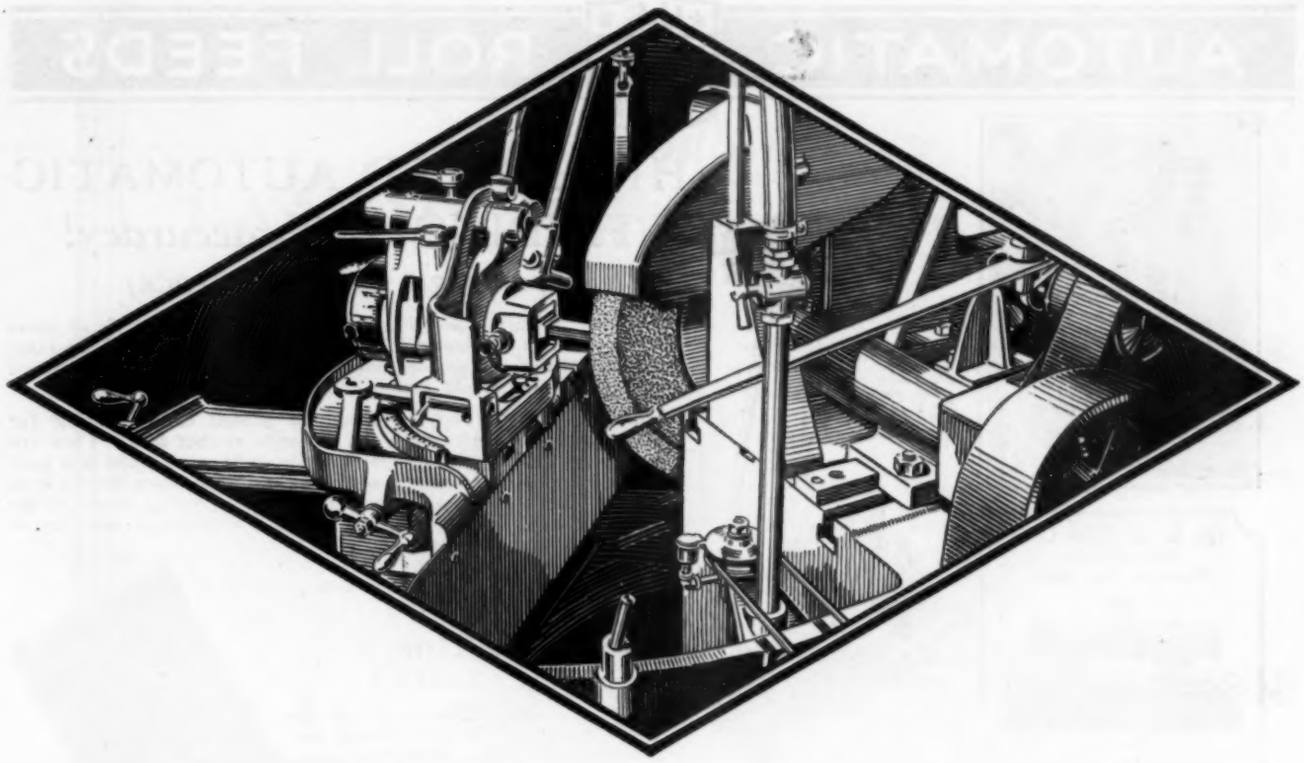
Planers have changed. Your old Planers may be in good running order—but investigate the Gray Maximum Service Planer and you'll see how wasteful it is to keep your old machines running. *One* motion sets the feed, (a *positive* feed, not a friction feed.) *One* motion gives Power Rapid Traverse of any head in any direction, (a distinctive Gray feature). *One* motion raises or lowers the rail by power. The drive train is of steel,—gears running in oil, and helical throughout.

There are many other features and every one of value to *you* in *your* shop.

Maximum Service Planers
Open-Side and Double-Housing



The G. A. GRAY CO.
CINCINNATI, OHIO



TOOL STEEL GOES FARTHER

a Sellers + Quality

Tool steel is expensive—don't waste it. The Sellers Tool Grinder automatically duplicates the exact required angles and shapes of cutting tools, grinding away only the minimum amount of metal necessary to produce or restore the correct shapes. With the Sellers Tool Grinder, one operator grinds all tools in a centralized tool-room. Every grinding produces the maximum quality and quantity of work because the tool is right by formulae—not approximately so, according to each workman's individual opinion or skill. Standards are established and maintained. Production is speeded up because workmen remain at their machines. Rejections due to poorly ground tools are eliminated. Labor costs for grinding are minimized.

WILLIAM SELLERS & COMPANY
INCORPORATED
ESTABLISHED 1848 PHILADELPHIA, U.S.A.

Sellers Industrial Tools comprise Drill Grinders, Tool Grinders, Spiral Gear Drive Planers, Boring and Turning Mills, Floor Boring Machines, Planer Type Milling Machines, etc.

SELLERS MACHINE TOOLS +

Sellers Railroad Tools comprise Car Wheel Lathes, Driving Wheel Lathes, Car Wheel Borers, Driving Box Borers. Also manufacturers of Sellers Locomotive Injectors.

AUTOMATIC ★U.S.★ TOOL ROLL FEEDS

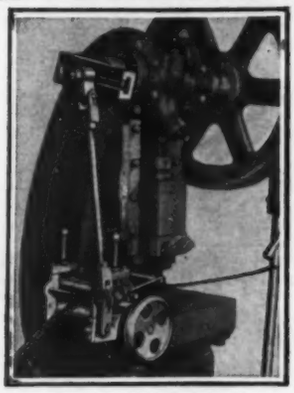


Illustration at left shows application of the U. S. Tool Automatic Roll Feed to a standard press.

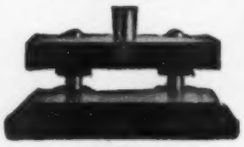
HIGH SPEED AUTOMATIC FEEDING—*with accuracy!*

(FOR STRIP OR REELED STOCK)

U. S. Tool Automatic Roll Feeds are adaptable to any style of press and are entirely automatic in operation enabling a single operator to handle a battery of presses running at a much higher rate of speed than hand feeding would permit.

Feeding is controlled by hardened and ground cams assuring far greater accuracy than through the old style ratchet feed. They are designed so that the rolls are released instantly when pilots are used on the die leaving the work in control of the pilots when the die is in operation. Rolls also assume control of stock on the up stroke of the punch. Manufactured to precision standards throughout—accuracy of feeding is maintained over many years of service. Speed up production and lower costs with these modern time and labor saving devices.

The U. S. Tool Line *also includes* **Standard Die Sets**



STYLE C

Designed for progressive die work in combination or gang dies. There *is* a difference in die sets—compare the features of U. S. Tool Die Sets and see!

We also manufacture a complete line of standard supplies for Diemakers, Toolrooms and The Metal Stamping Industry.

WRITE FOR THIS HANDY CATALOG!

Contains complete descriptions of the entire U. S. Tool line of Standard Die Sets and Accessories. Facilitates quick, easy buying. Address, Dept. A.

U.S. TOOL COMPANY Inc. AMPERE NEW JERSEY USA

SPLIT-SECOND CONTROL through a single lever

The single lever control on Greaves-Klusman Lathes speeds up production by saving time and effort and simplifying operation. With one lever the operator starts, stops, reverses and instantly selects any spindle speed.

Even an inexperienced workman can quickly learn how to operate these lathes and hold to production schedules.

Other advanced features that insure more and better work are the special design spindle nose, sliding transmission, geared head, location of motor in leg, new patent friction, double plate apron and new patent tailstock.

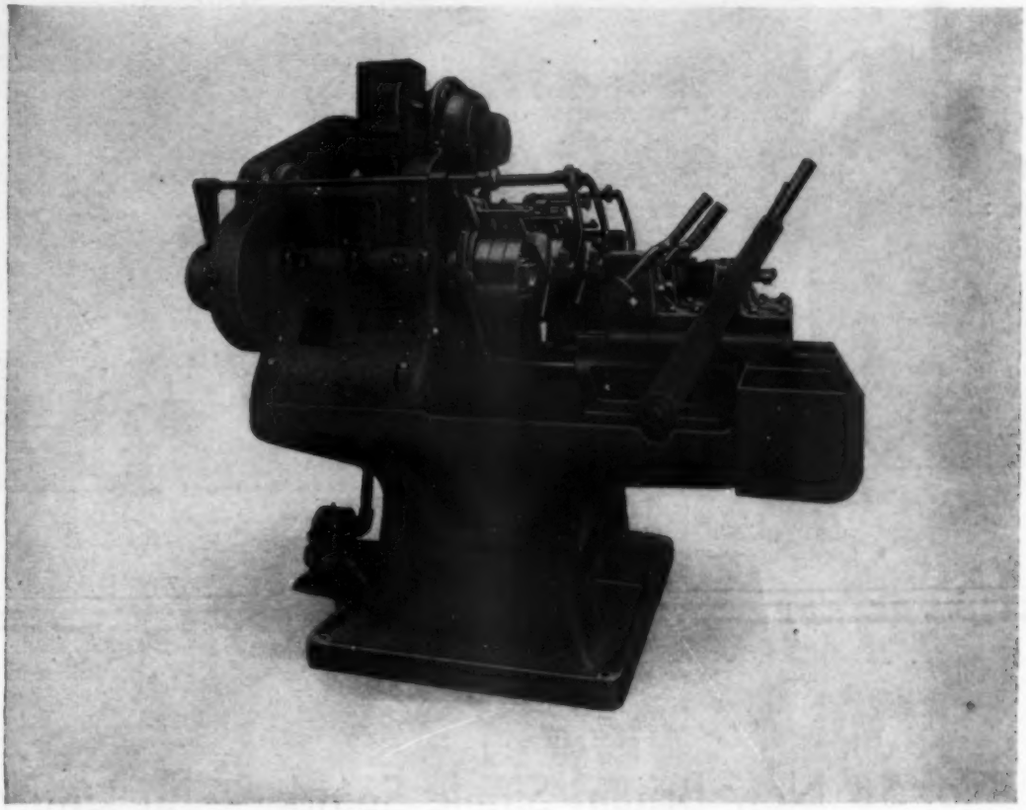
Let these up-to-the-minute machines reduce your costs to new low levels. Write for Catalog.

The Greaves-Klusman Tool Co.
Cincinnati, Ohio

BOOST PROFITS

with the

LANDIS Bolt Factory Threader



The *Profit* to be had from a machine tool depends upon its ability to produce accurate work economically and quickly.

The LANDIS Bolt Factory Threader is an ideal unit for production runs of bolts. The patented LANDIS chasers backed by the sturdy *LANCO heads* insure the accuracy, economy and high productions which are so essential for profits.

The compactly spaced die heads, the free sliding movement of the carriages and the radial adjustment of the carriage operating levers for position make it possible for the operator to keep up with the high threading speed of the chasers without fatigue.

Then too, the spindles are fitted with clutches, controlled from the front of the machine, which permit of the independent operation of the threading heads.

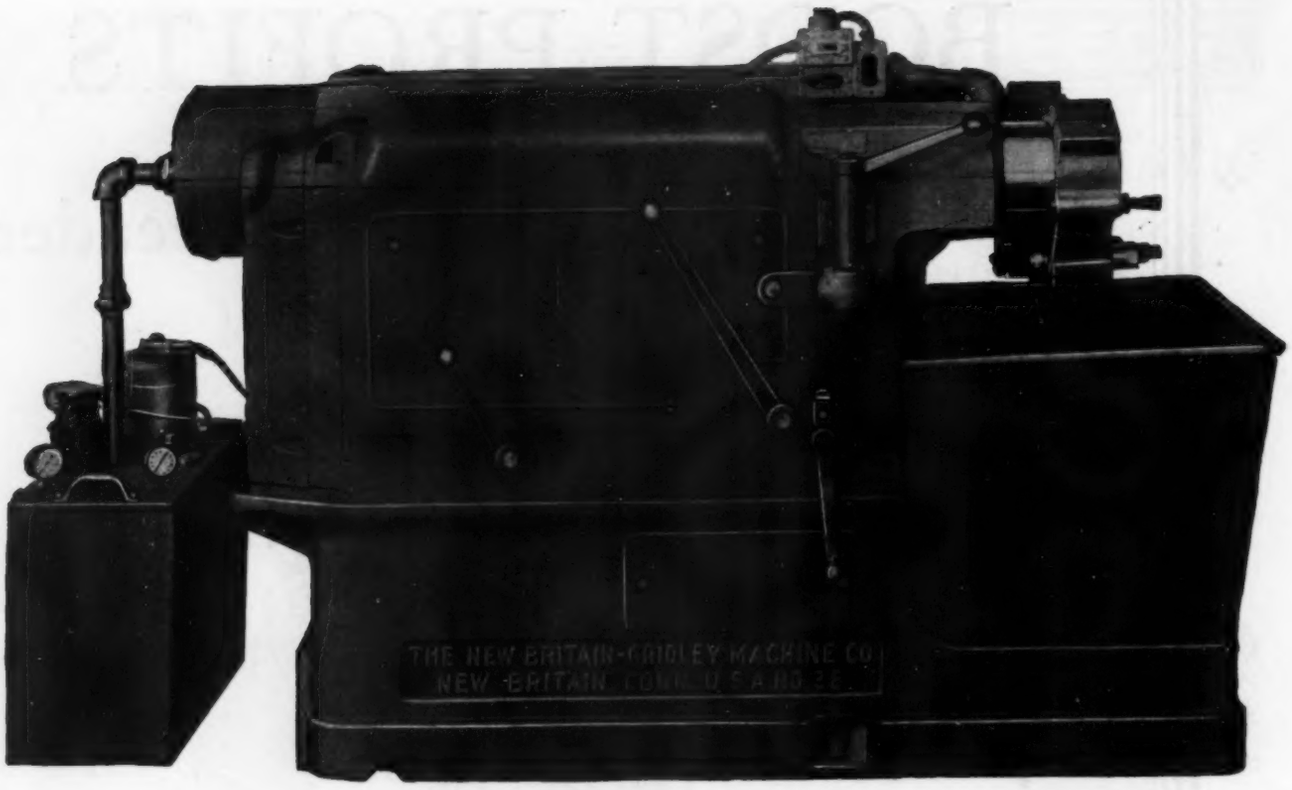
All LANDIS literature has been revised and is now available. Requests should specify type of die head or machine. Write today.

LANDIS MACHINE CO., Inc.

Waynesboro, Penna.

Detroit—5928 Second Blvd. **Cleveland—504-505 Marshall Bldg.**

Agents in all principal cities of the world



No. 38 New Britain Single Spindle Chucking Machine

Two tool arms, sufficiently rigid to amply support tools at maximum cuts, and capable of travelling radially and longitudinally, adapt the No. 38 Single Spindle Chucking Machine particularly well to the production of Ball Bearing Rings and simple Ring Gears.

An angular overhead slide may be applied for machining the bevel face on Differential Ring Gears or on other work of complicated nature requiring angular cuts. An overhead slide may be set perpendicular to the spindle axis if the nature of the work requires this.

The two tool arms and the overhead slide may work either alternately or simultaneously and function entirely automatically.

THE NEW BRITAIN-GRIDLEY MACHINE CO.
NEW BRITAIN, CONN.
U. S. A.

Just one wrench

required to make adjustments on the Cincinnati Rapid Traverse Shaper. The same wrench fits them all—tool post, vise, table support, rail clamp, and clapper box.

This—like the easy speed and feed changes, and built-in power rapid traverse to the table—is just another one of the refinements on the Cincinnati that lessen the set up time.

You should study the many shaper refinements, exclusive to Cincinnati Shapers, described in detail in our catalog. Write for it.

Cincinnati Shapers
Rapid Traverse

THE CINCINNATI SHAPER CO., CINCINNATI, O.

Large Heavy Machines for Large Heavy Work —Nos. 33 and 35

THE two largest sizes of the Brown & Sharpe "30 Series" Plain Grinding Machines, the Nos. 33 and 35, are designed to accurately and economically grind long, heavy work, such as large spindles, rolls, milling machine overarms, etc. The rugged construction of these machines in general and the massive wheel slide in particular, assure rapid, accurate grinding on large work.

The replacement of obsolete machines with modern high production equipment will assist you in lowering your costs and improving your product. It will be of advantage to you, if you grind work within the capacity of the Nos. 33 or 35, to get in touch with the Brown & Sharpe Grinding Service.

The «30 Series»

No. 30 12 x 18	No. 32 14 x 36
No. 33 14 x 48	No. 35 14 x 72

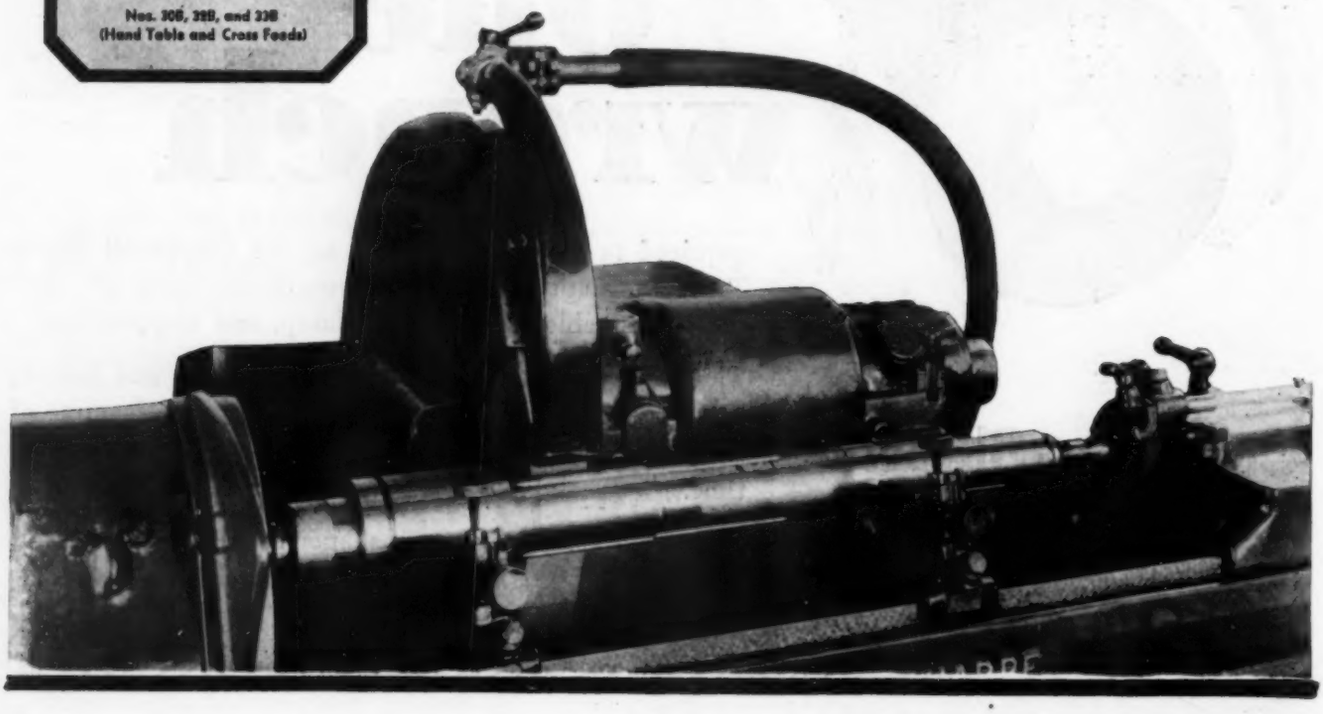
MODIFIED MACHINES

Nos. 30A, 32A, and 33A
(Power Table Feed for Wheel Truing, and Power Cross Feed)

Nos. 30B, 32B, and 33B
(Hand Table and Cross Feeds)

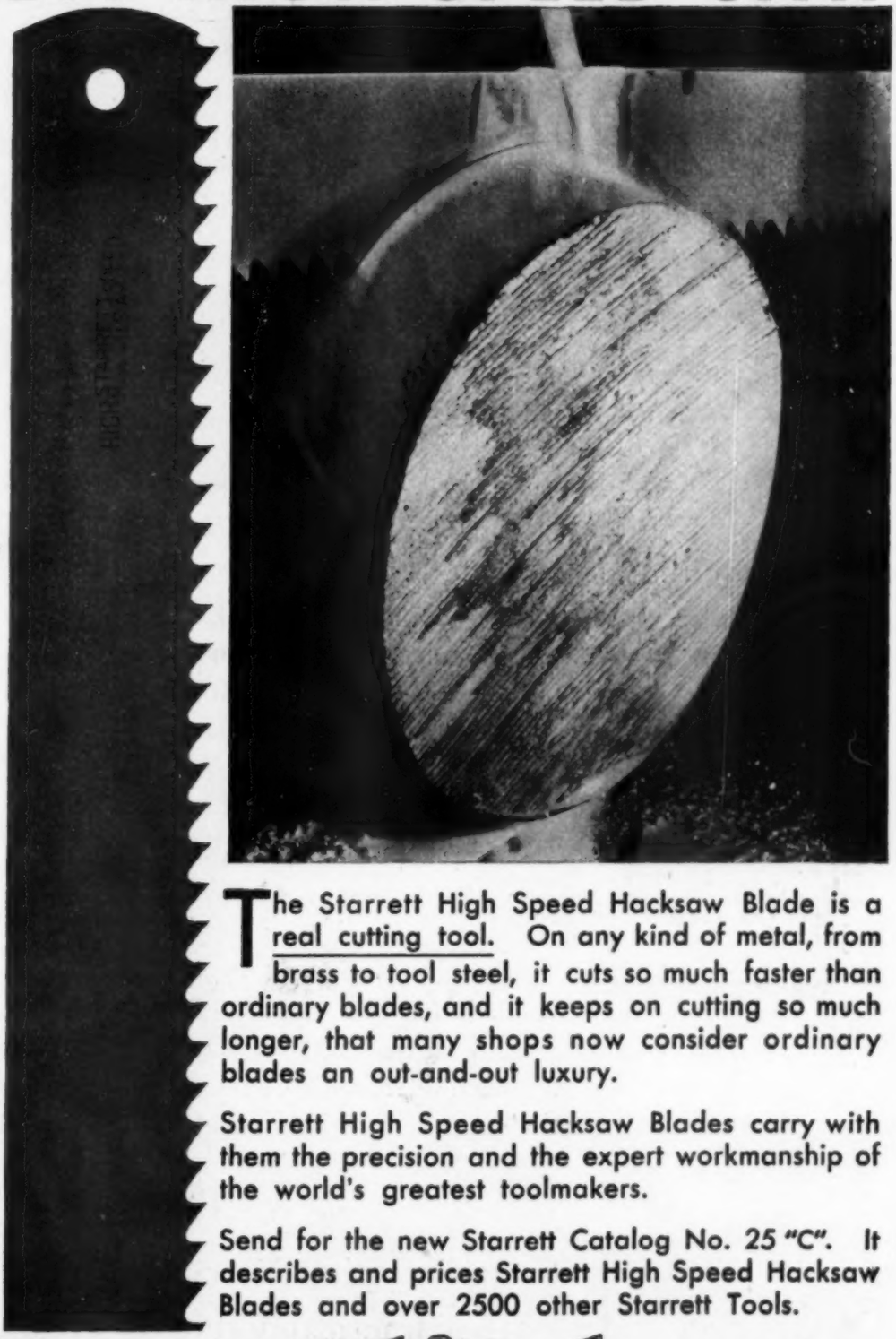
BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.



TRY A STARRETT HIGH SPEED SAW

For low cost cuts, use Starrett High Speed Hacksaw Blades



The Starrett High Speed Hacksaw Blade is a real cutting tool. On any kind of metal, from brass to tool steel, it cuts so much faster than ordinary blades, and it keeps on cutting so much longer, that many shops now consider ordinary blades an out-and-out luxury.

Starrett High Speed Hacksaw Blades carry with them the precision and the expert workmanship of the world's greatest toolmakers.

Send for the new Starrett Catalog No. 25 "C". It describes and prices Starrett High Speed Hacksaw Blades and over 2500 other Starrett Tools.

Use Starrett Hacksaws

50th Anniversary of Starrett Tools 1880—1930

THE L. S. STARRETT CO. 3840

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes — Standard for Accuracy
ATHOL, MASS., U. S. A.

"DILIGENTLY!"

106—"We go over the advertisements in the American Machinist so *diligently* that my copy is well cut up before it is returned to me."

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Electrical Equipment, New Jersey.

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"After reading the magazine myself, our copy is routed to our factory manager, chief engineer, and purchasing agent. Both are very much interested in the advertisements."

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SUPERINTENDENT
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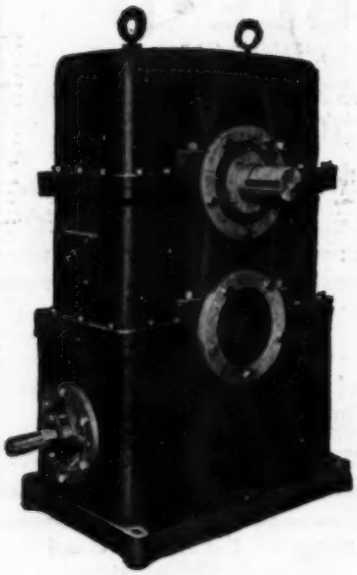
[Shop Executives Everywhere Tell of the Practical Value to Them of American Machinist Advertising]

(106 to 110 of a series)



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(ONE NAME-ALL TYPES)

made in ALL types Standard and Special

That tells the whole story—a story of *complete service* unmatched in this field. From one company, with one undivided responsibility you can now get SPEED REDUCER advice on sound, unbiased engineering principles. The units shown here are typical of our "specials," which include right angle drives, multi-speed gear changes, combination of Spiral Bevel and Herringbone Gears and Spur Gears. All shown and described in our big NEW 120-page Catalog. Write for your copy today.

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Manufacturers of Industrial Gears and Speed Reducing Units

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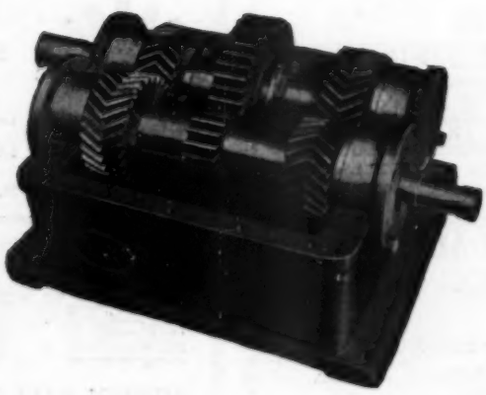
Power Saving Products

GEARS, Spur, Worm, Herringbone, Internal, Bevel, Miter, Intermittent, Spiral, Helical, Continuous Tooth Herringbone Gears, Spiral Bevel Gears, V-Belt Drives.

NON - METALLIC PINIONS: Fabroil, Textolite, Rawhide.

Whitney Silent and Roller Chains, Sprockets, Flexible Couplings, Universal Joints, Racks, Ratchets and Pawls, and a complete line of gear driven

SPEED REDUCING UNITS



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An ideal combination of semi-steel Sheaves by "Phillie Gear" and Belts by "Gilmer." This rounds out the complete line of "Philadelphia" Industrial Drives.

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Nothing Commonplace

Enters into the making of Hartford Gears. Skilled machinists with the aid of modern equipment turn out products that win customer's OK.

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BILGRAM
QUALITY GEARS
SINCE 1880
Bevel Gears
Spiraloid and Straight Teeth
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All Types of Gears
The BILGRAM MACHINE WORKS
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SPUR—BEVEL—MITER & WORM
GEARS and RACKS. CUT TEETH
DOUBLE-D
All Metal Silent Gears
RAMSEY
SILENT CHAIN DRIVES
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Your Machine Product May Be Judged By Its Gears
It pays to use gears that will not invite future trouble and customer dissatisfaction when genuine MEISEL GEARS can be purchased at such a reasonable cost.

MEISEL GEARS—of every type—are made to high precision standards from the finest materials and to give the best service under every working condition.

We also do splining, broaching, tooth rounding and screw machine work. Ask us for quotations.

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Spur - Helical - Bevel - Worms - Screws - Racks
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THE ADAMS COMPANY (*Est. 1883*) 1900 Bridge St. Dubuque, Iowa

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Cut Spur, Bevel and Worm Gears
All sizes. Every description. Operating Machinery for Bridges, etc. "Lea Simplex" Cold Metal Saws.
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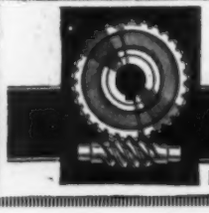

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CLEVELAND WORM AND GEAR COMPANY
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Dependable Gears
Spur, Straight Bevel, Spiral Bevel
Helical, Internal
In all metals and non-metallic materials.
Let us quote from blue prints or specifications.
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The BANTAM BALL
32nd Year BEARING CO.
SOUTH BEND INDIANA
JOURNAL—RADIAL—THRUST
Ball and Roller Bearings—½ to 48 inches in diameter.
ONE OR A MILLION
New York, Detroit, Chicago, Pittsburgh, Cleveland, St. Louis

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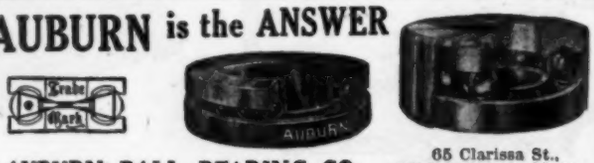

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Complete stock carried by

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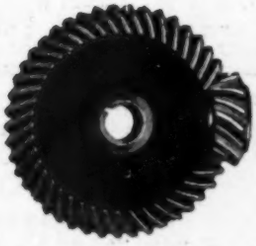
PERKINS GEARS

on a contract basis—

We are ready to furnish gears of almost every type and size and in any quantity. Our attractive contract rates save money for the purchaser. Send blue prints for estimate.



Perkins Service covers full cooperation on all gear problems. Consultation with our engineers is cordially invited.

Perkins Gears stand out in accuracy, uniformity, and long life.

Write for particulars.

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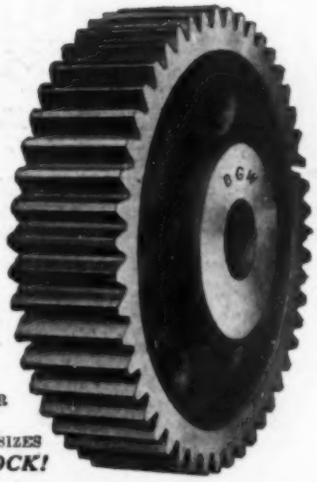
110 Circuit Ave., Springfield, Mass.

PERKINS Ground Thread Worms — *A Specialty* —

FOR **HEAVY DUTY**

FROM STOCK!



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PIONEER MANUFACTURERS SINCE 1886

Arc Welders
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Spot, Butt, Seam and Projection Welders
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SPOT-BUTT-SEAM
PORTABLE
TAYLOR-WINFIELD WELDERS
For labor-saving lower-cost production
The TAYLOR-WINFIELD CORP., WARREN, O.

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No. 8 Combination Torch and Melting Pot

Double efficiency with this inexpensive unit. Performs two important operations easily and economically. Melting pot holds 22 pounds of lead or soft metal. The burner is adjustable to any angle or may be removed and used as an efficient hand torch. Write for prices and specifications.

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High Temperature
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Will maintain 2400°F. Economically, with guaranteed satisfaction.

This small Sentry furnace is widely used in Tool Rooms for Hardening High Speed and Carbon Steel. It has met with universal approval both for production hardening of steels and for laboratory high temperature experimental work.

Consult us on your heating requirements. We will gladly co-operate in their solution, and send you Bulletin 1008-1 describing exclusive Sentry Features.

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ELECTRIC TOOL STEEL

High Speed Carbon

Highest Quality—Best Practice

Latrobe Electric Steel Co., Latrobe, Pa.

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COLD DRAWN STEELS and SHAFTING
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SC&H Furnaces are built in all sizes of Oven, Pot, Continuous, and Special Types for Electric, Oil or Gas application.

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CARBON ALLOY
TOOL STEEL
VANADIUM-ALLOYS STEEL CO.
LATROBE, PA.

HOT, QUICK HEATING GAS BURNERS AND FURNACES. NO BLOWER OR POWER REQUIRED

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"American" Electric Furnaces
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Forges, Blowpipes, Gas Blast Burners, Furnaces and Heat Treating Machines for every industrial purpose.

Bulletin A.M.20 on request.

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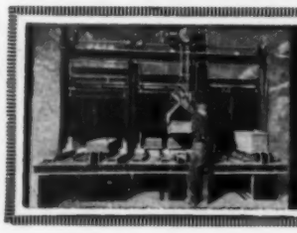

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FURNACES
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Send for Bulletins
The Electric Furnace Co.
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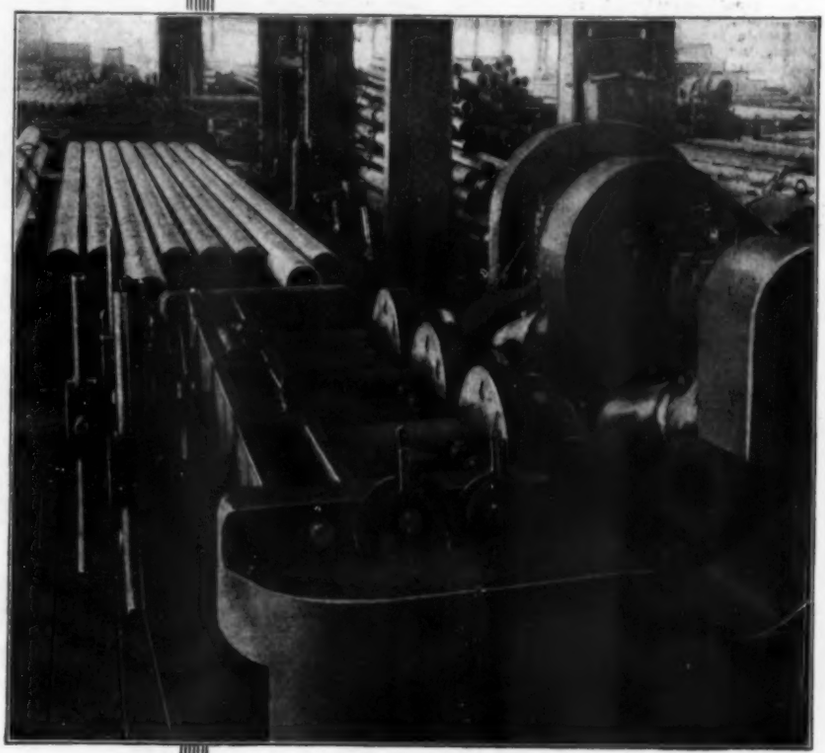
Straightening the TUBE . . .

. . . COOLED after the final hot-rolling operation, Pittsburgh Seamless Pipe and Tubing is again carefully inspected for flaws and sent to the straightening machines. Different types of machines are used for this purpose, depending upon the diameter and length of the pipe and the required accuracy. By passing through specially designed rolls, the pipe is straightened within commercial tolerances. After being cut to required length and inspected for size, gauge and surface defects, the pipe is ready for hydrostatic test and shipment.



From ore to finished pipe or tube, every single step in the manufacture of Pittsburgh Seamless is controlled by one Company that has devoted more than a quarter-century to the manufacture of seamless steel products exclusively.

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Division of
Pittsburgh Steel Co.

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St. Louis Tulsa Houston

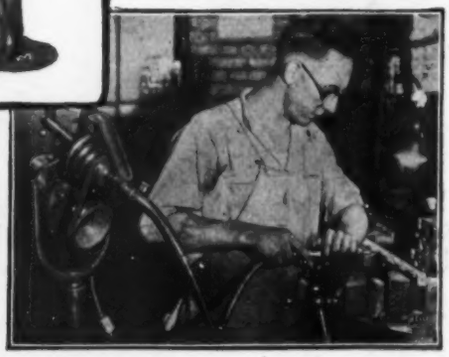
Pittsburgh P Seamless

PIPE AND TUBING

3031

From ore to Finished Pipe or Tube, Pittsburgh Seamless Pipe or Tubing is the result of one Company's resources and Skill.

THE KELLERFLEX



KE

The great assortment of Keller burs and rotary files in hundreds of different shapes, sizes and cuts, is indispensable for work on steel, bronze, aluminum, copper, rubber, horn, wood, etc.

The KELLERFLEX machine with its various speeds enables a ⅛ in. bur to be used as effectively as a 1 in. bur. This machine is ideally suited for work in the foundry for cleaning, trimming of bronze and aluminum castings, as well as finishing of patterns.

The illustration shows the BK 1 machine being used with a bur on metal pattern work.

You will be surprised to learn the many ways that this machine can reduce your operating costs throughout your entire plant.

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76 Washington St. Brooklyn, N. Y.
Complete stock at Chicago and Brooklyn Offices

Service **Strand** Quality
FLEXIBLE SHAFTS

TOOL and DIE MAKERS EQUIPMENT

This type RF-M4 Equipment is an exceptional machine for general use in the making of tools and dies.
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is what we expect to use in the future—

TIREX NEVER KINKS

Asked about portable cord, a prominent engine manufacturer spoke up as follows:

"We have been using TIREX for the past two years. It is the best thing we have been able to find and is what we expect to use in the future."

Let us prove this will do as well for you.
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INCLUDE
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More efficient, compact, adaptable.
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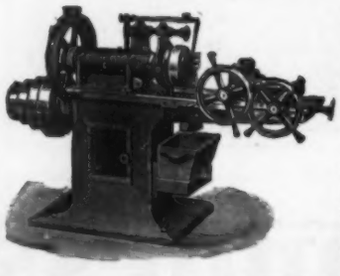
Strength and Weight



help to give Acme Bolt and Nut Machines their undoubted superiority as immediate cost reducers on all work in their capacity.

They turn out work faster than others and perfect accuracy can be depended upon. Write us for description of our entire line. Catalog?

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Mule-Pull Clutches
Flexible Couplings
Sectional Stock Racks
Loose-Pulley Lubricators
Time-Saving Vises.
Brown Engineering Co.
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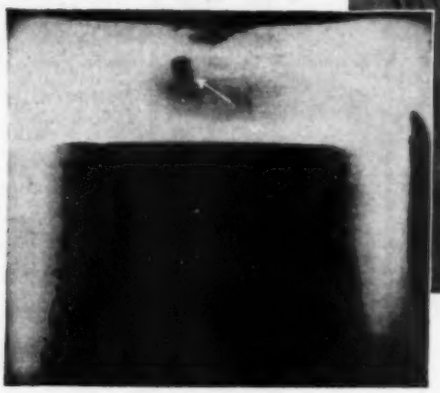
The Value of the X-ray Inspection Is Reflected in the Finished Part



The radiograph reproduced at the left shows a serious hidden cavity caused by gas inclusion.

WHETHER it be special castings or those used in machine shop routine, the value of x-ray inspection is reflected in the machined part.

Inspection with x-rays is not destructive as is sectioning, yet it provides a "picture" of the internal structures. Cracks, blowholes, cavities, gas inclusions, segregations, and other defects can be seen plainly in the radiograph. *No other method of inspection provides these advantages.*

When a periodic x-ray check-up is made between the foundry and machine shop, countless hours of expensive machining time are saved and a better quality finished product results.

There are many applications of x-rays in modern industry. Send for your copy of the interesting booklet, "X-rays in Industry." It's free.

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Gentlemen:

Please send me a copy of "X-rays in Industry" which I understand is free.

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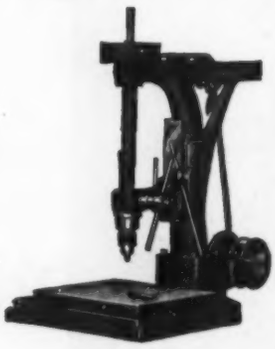
Leland-Gifford makes drilling machines to meet all production requirements.

Drilling and tapping advice cheerfully and promptly furnished.



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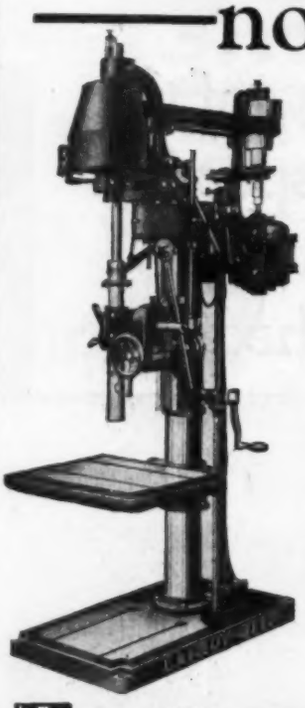

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Dynamically Balanced Cone Pulleys

Single Lever Control Back Gear

Flexible Coupling to Motor

PUSH BUTTON CONTROL

and a dozen other old and new features that you'll want to know about in this C-O 21-in. SLIDING HEAD—SELF FEED—DRILL

Send for a complete description.

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407 Broome St.
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Precision Built Drilling Units

UNIVERSAL (HORIZONTAL) BORING MACHINES

For tool room work and large production.

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HUDSON, MASS., U. S. A.
"Where accuracy counts, we win"

4377

10 *Big Features of the* Victor *5-Speed Super* Drill

1. Ball bearings in ALL revolving parts and end thrusts. 2. Wonder pulley chamber and speed lever that regulates r.p.m. 3. Standard Jacobs or Ettco chuck—½-in. capacity. 4. Spindle travel—2 in. 5. Drill table absolutely level. 6. Positive spring belt lock. 7. Self-adjusting belt for 1600 to 4250 r.p.m. 8. ¼-hp. motor, 110 volts, DC. or AC. 9. Fully equipped with belt, switch, cord and plug. 10. Portable—weight 65 lb.

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Newtonville — Boston, Mass.

Four Different Styles Handle all Types of Small Hole Tapping . . .

Globe Automatic Tappers are made in drum, dial, conveyor and push feed types, single and multiple spindle design. Completely automatic. Part No. 7, 2 holes in skate clamp, 60 pcs. per minute. No. 8, ¼ x 20 hole tapped at 60 per minute. No. 9, wing nut, all sizes from 60 to 120 per minute. Write for bulletin and see how others are saving tremendous sums through automatic tapping.

Drum Type

GLOBE TAPPING MACHINE CO.
Bridgeport, Conn.

Globe

A Four-fold Saving for Your Shop

A DEFIANCE BORING—MILLING—DRILLING and TAPPING MACHINE performs all four operations with a single set-up.

A tremendous time and labor saver, that steps up production and maintains a uniform high standard in quality workmanship.

The revolving index table either round or square top—facilitates set-ups.

The powerful drive through ball and roller bearings and the centralized control will speed up any job.

Actually—one Defiance replaces four individual machines.

Defiance Machine Works
Defiance, Ohio
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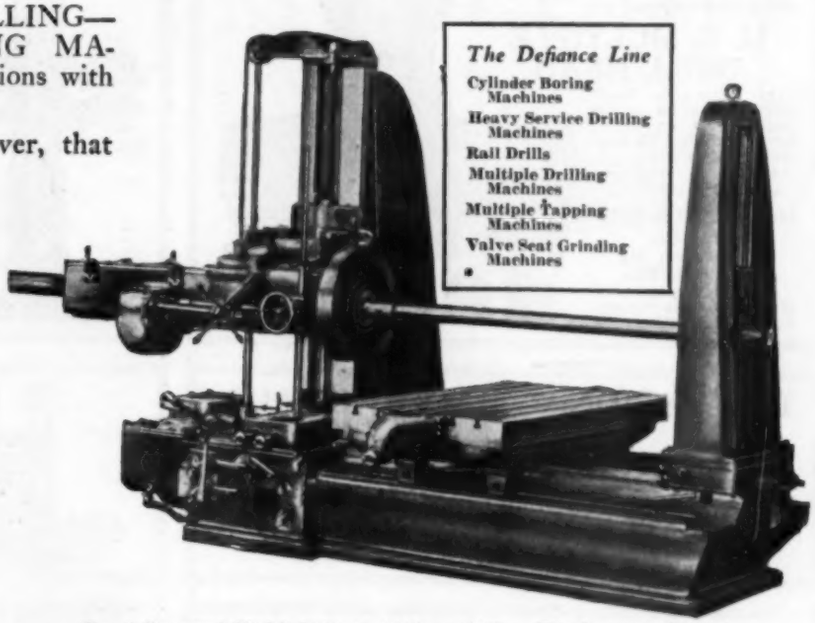
Since 1850



No. 6 Improved Model Defiance 4½-in. spindle. We also manufacture smaller sizes—No. 5 with a 3-in. spindle, and 5A using 3¾-in. spindle.

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BORING—MILLING—DRILLING AND TAPPING MACHINES

SELF-OILING ALL-GEARED DRILLING AND HONING MACHINES

cut costs and increase production

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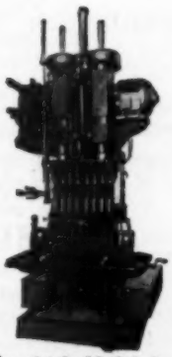
Write today for Catalog A



No. 214—Multiple Cylinder Honing Machine.

BARNES DRILL CO.
830 CHESTNUT ST. ROCKFORD, ILL.

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New York, 200 Broadway; Boston, 830 Old South Bldg.; Chicago, 549 W. Washington Blvd.;
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Most highly Specialized for each job, yet most widely adaptable for future requirements.

Our High Speed Tappers are Super-Sensitive for Small tapping.

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DRILL PRESS TURRET
Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder, if required.

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Drilling an even dozen

When a prominent automobile concern wanted to cut production costs, they ordered a

U. S. MULTIPLE DRILL HEAD

This particular head drills 12 holes at a time. But we make any type to suit any particular need.

Let us know your particular problem.

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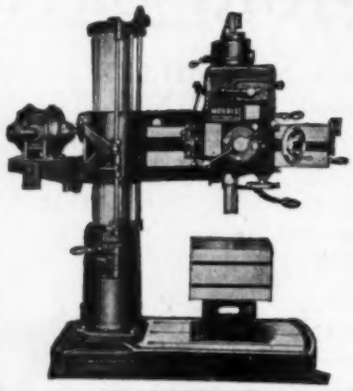

Today makes no demands on the Morris Mor-Speed Radial that this highly productive machine cannot easily meet.

Speed, power, centralized control—you'll find that and more in a Mor-Speed.

Send for the MOR-SPEED catalog.

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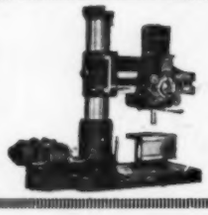
ORIGINATORS OF MODERN BOLT, NUT AND FORGING MACHINERY



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The Carlton All Ball Bearing Radial Drill pleases its users. Has done so for **TEN YEARS** and will continue to do so. Learn all its features and you'll see why.

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Their "minute-saving" features of design will greatly increase your drilling output and profits. Get the complete details from our branches in the principal cities.

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MULTIPLE SPINDLE DRILLERS

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101 Varieties—All Adjustable—Write for Catalog

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Puts perfect points on small drills, reduces breakage, increases production. Our bulletin explains. Also ask about Drillpointer for large drills, Point Thinner, Mill Cutter Grinder, Tap Grinder and Die Making Machine.

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Noiseless, clean and without vibration.
A complete drive for any bench machine.
"If it's Rivett it's right."

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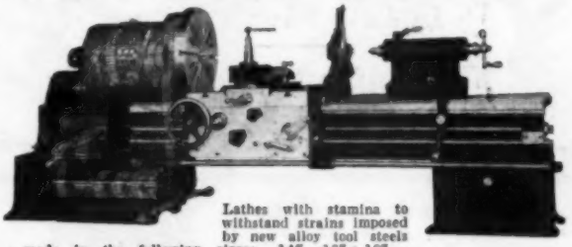

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Model R— Automatic

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when it comes to turning.

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The design incorporates the most advanced principles of modern machine tool practice—backed by over fifty years' experience as specialists in this field.

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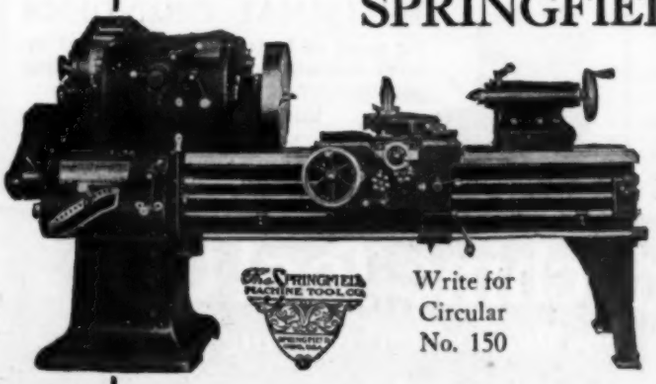

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Money Makers on Every Job

Lathe efficiency is determined by the margin of profit made possible on every job.

If you are looking for a lathe with real money-making features, let us give you all the details of the improved Springfield Ball Bearing Geared Head Lathe.

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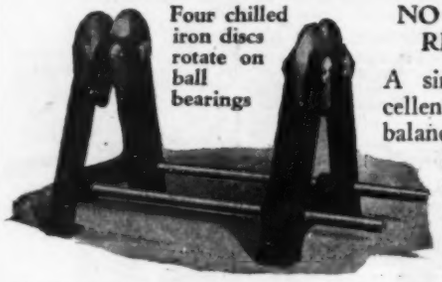

Four chilled iron discs rotate on ball bearings

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Either Horizontal or Vertical Spindle Type
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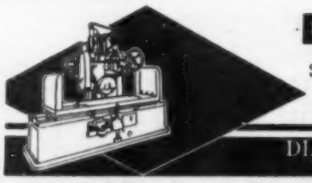

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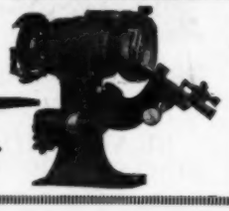

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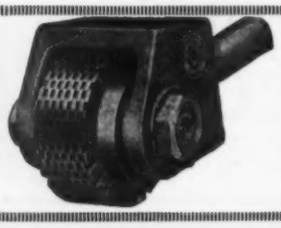

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For dressing precision wheels. In many cases an excellent substitute for the diamond — at much lower cost. *Send for Circular.*

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SURFACE GRINDERS
Nos. 10-16-27R—High Power
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Blanchard Grinding Wheels
Reaming Machine
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Manufacturers of Grinders, Buffers, Speed Lathes and Manual Training Lathes.
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INTERNAL GRINDERS

for small or large hole grinding used by most railroads and many of the leading manufacturers.

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You can get them on time from Jones. Modern equipment assures quick service, right prices and unsurpassed accuracy and quality. We will be glad to quote you on spur, worm, bevel and mitre gears — cut or molded — in cast iron, steel or bakelite. Also herringbone gears. Your inquiry will have prompt attention. Write us.

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We make gears to order
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There are Racine Machines for every metal cutting job.
The Shear Cut for Production Work.
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Accuracy, speed and long life are inbuilt characteristics of this equipment. Write.
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Quality Unrivalled is Packaged in Plaid!

Hack saw blades—band saws—screw drivers—glass cutters—good mechanics the country over are sure of uniform high quality when they ask for
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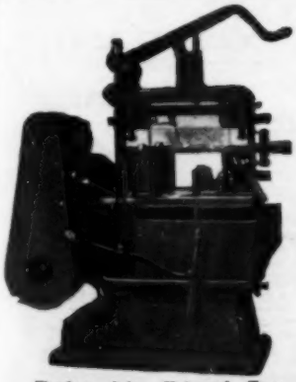

Peerless 9-in. Universal Type Metal Sawing Machine.

Saw Faster and More Accurately

Peerless 9-in. Universal Type Metal Sawing Machines excel by their rapid production in cutting-off work and by their wide range of application in blocking out work or in sawing special shapes.

Peerless 6-in. Standard Type Metal Sawing Machines cut accurately because of the straight line pull on the blade, the extra long guides and the blade cooling system. The quick acting vise and automatic lifting device are features.

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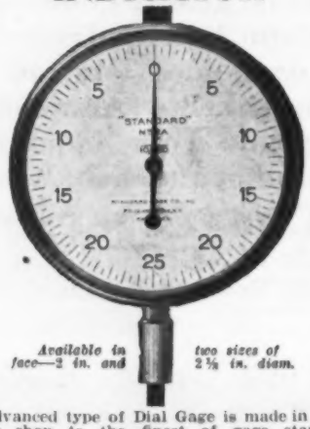
Peerless HIGH SPEED Metal Sawing Machine

Peerless 6-in. Standard Type Metal Sawing Machine.

SUPREME ACCURACY

STANDARD DIAL INDICATOR



Available in two sizes of face—2 in. and 2½ in. diam.

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Model 8 *Checks to within + or — .0005 in.*

Where low assembly costs depend upon *quick precision fit* of parts, fortify against inaccuracy with FEDERAL DIAL INDICATORS.

"A dial indicator for every precision measuring job, with exclusive accuracy features." Write for Catalog.

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Should Be Done With Up-to-date Equipment—
You cannot afford to experiment.

The STANDARD SCLEROSCOPE (Now Highly Improved) for more than twenty years has made good and is still used for doing the world's hard work in testing. In general use for specification purposes. Simple, Sturdy, Comparatively Inexpensive. Illustrated bulletins free.

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Ames Amplifying Comparator

An unusually rugged and durable gauge for testing parts in quantity with speed and accuracy.

It Repeats Its Readings!
Send for Special Bulletin.

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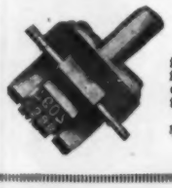

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Automatic Numbering Heads will prove economical
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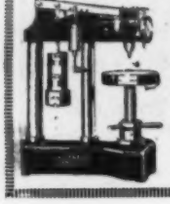

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The WHITON

GEARED SCROLL COMBINATION CHUCK

This is the chuck for general manufacturing and machine shop purposes. Made with iron bodies in three or four jaw types to operate independently or universally.

As in all Whiton Chucks, Quality is a predominant feature. The Whiton line of chucks is a complete one—all types, iron or steel bodies for light, heavy and medium work.

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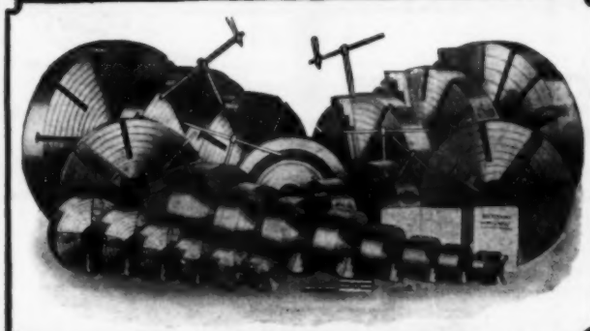

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Note the short stock drive, nearest the cutting point, affording utmost rigidity.

Write for catalog illustrating our Quick Change Chucks and Collets as well as our Tapping Devices and Screw Drivers.

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HAND CUT STEEL STAMPS
FORMERLY "YALE BRAND"

The life of a stamp depends on the correct shaping and proper tempering.

Try the
Hoggson Brand
for stamps or Marking Dies of all kinds.

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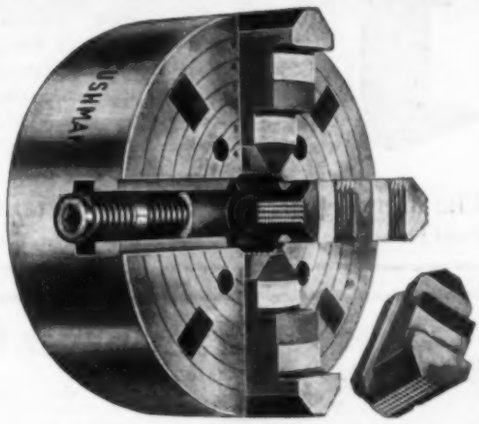
"IT'S OLD AND YET IT'S NEW"

A CUSHMAN CHUCK

Made only as Cushman can make it



"INCOMPARABLE"
THE 4-Jaw Independent Chuck

Why the "INCOMPARABLE" is *incomparable* and *should replace* the chuck made for a day that is gone.

Bodies

Made only of the best of Steel or Gray Iron Castings.

Jaws

Of an Alloy Steel, selected as best for the purpose and heat-teated.

A Full-length Screw Contact and Every Surface is Hard.

Grooves are wide to coincide with the extra large heavy ribs of the body.

Although these Jaws are free-moving and interchangeable they have been ground to maximum and minimum gauges with only .001 in. tolerance.

They are reversible.

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Chrome Nickel Steel Heat-Treated.

They engage the Jaws from *end to end* and are Self-Cleaning.

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Of special tough carbon steel heat-treated — Self-Aligning—Always hold the screws in correct relation to the jaws. 100% thrust area, for they fully encircle the screws.

This is the Cushman patented bearing which has proved itself superior to every other.

A Cushman Catalogue will tell you much more about The "Incomparable" and why it is a Standard of Excellence for 4-Jaw Independent Chucks.

This is No. 2 of a series of advertisements

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DAYTON
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SWAGING MACHINE —with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Modern Art of Swaging."

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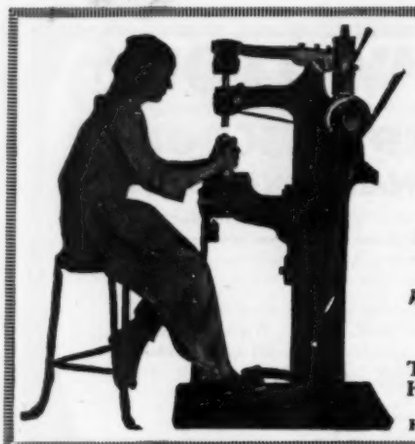

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RIVETING
HAMMER
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Cold Riveting
1/64 in. to 1¼ in. in diameter

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They never fail

— to show unbelievable economies in all types of stamping. Wright Dieing Machines are a new and advanced type of Punch Press combining several distinct advantages not obtainable in any other machine. Write for detailed description and data of accomplishments in nationally-known shops.

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Automatically Oiled Die-Sets

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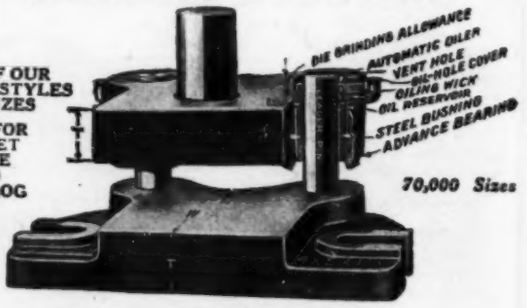

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GENERAL OFFICE AND WORKS
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Sixty-six years' experience in designing and building presses.
Send us your press problems.
FERRACUTE MACHINE CO.
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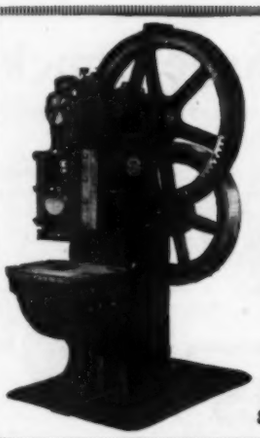

"ADRIANCE"
Punch Presses

Sturdy tie-rod construction assures long life for press and tools, with expedition and accuracy of performance in punching, bending, forming and perforating operations.

ADRIANCE MACHINE WORKS,
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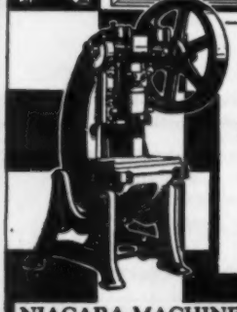

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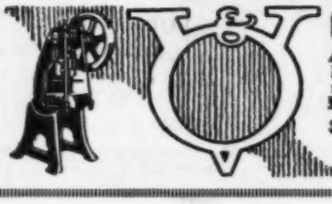

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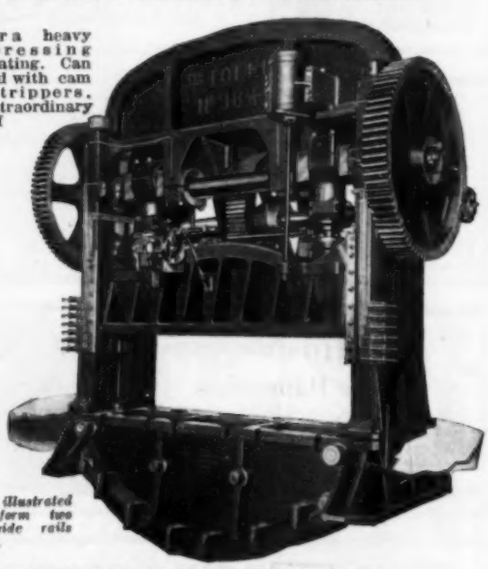

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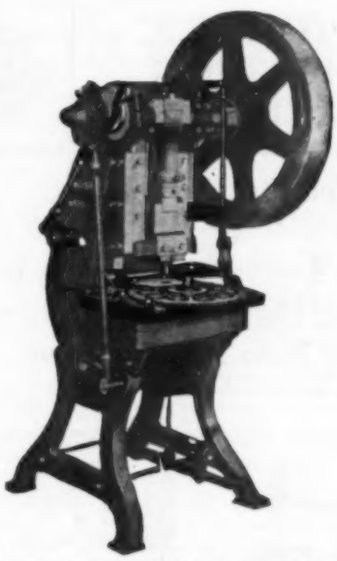

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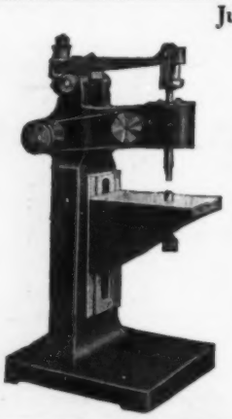

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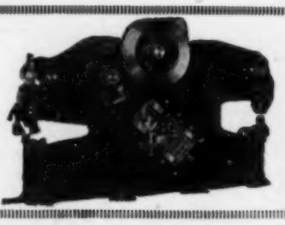

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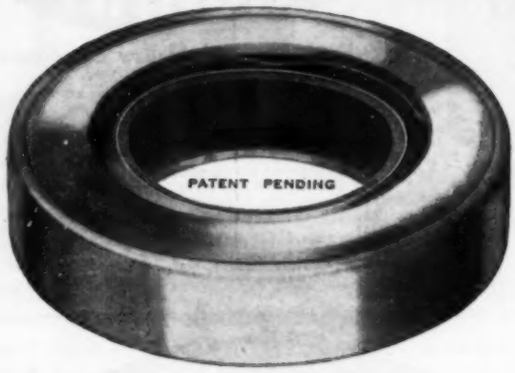

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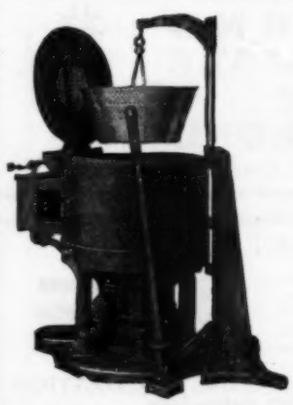

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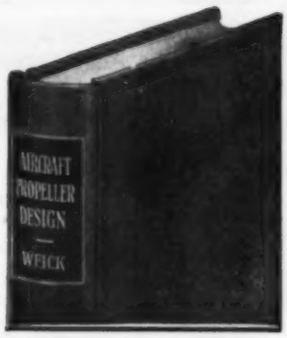

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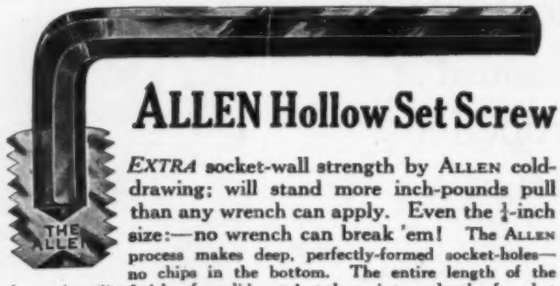

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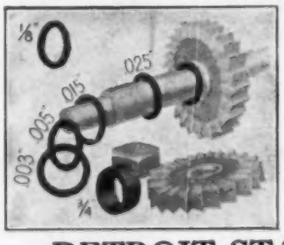

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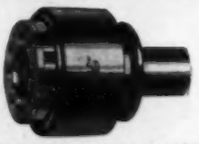

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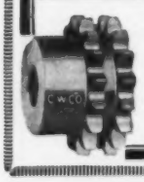

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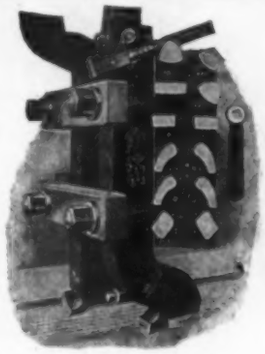

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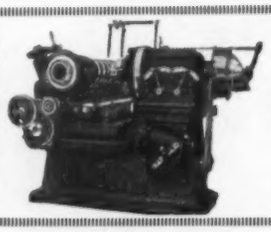

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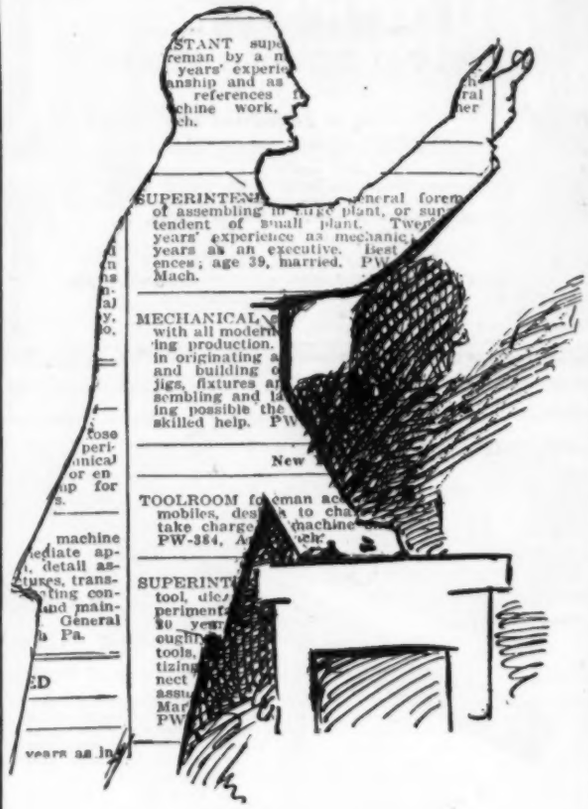

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6"x6" long stroke.
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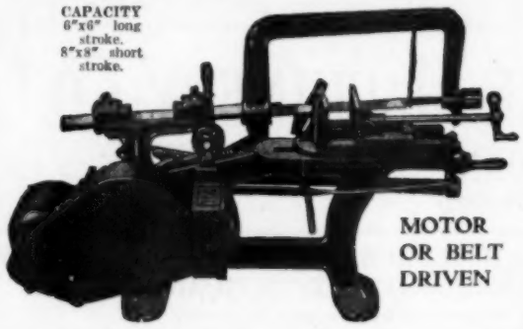

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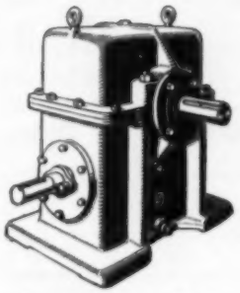

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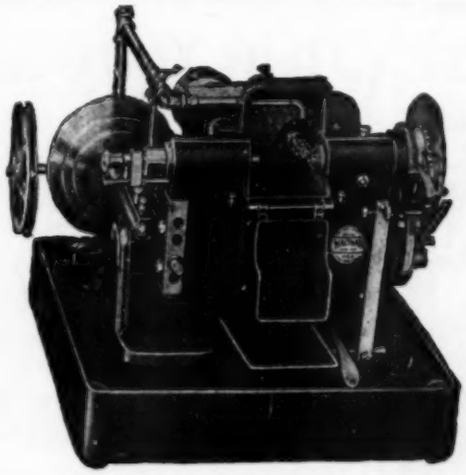

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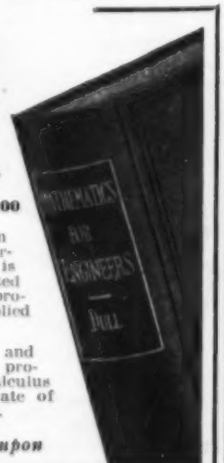

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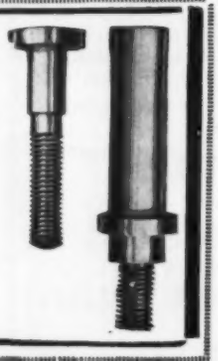

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8—24" Steinle, S. P. D.
8—24", 21" Gisholt.
3—No. 4-A, 2-A W. & S.
1—21x8' LeBlond Univ.
2—No. 6 Brown & Sharpe.
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3—2-spdle. Jones & Lamson.
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2—14" Warner & Swasey.
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11—No. 5-A, 6-A P. & J.
4—14" Fay Automatic.

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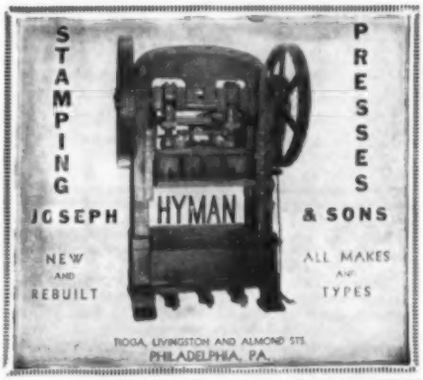

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STANDARD MACHINERY & SUPPLY
218 High St., Boston, Mass.

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On
Brand New
High Speed or Carbon DRILLS, REAMERS, CUTTERS, TAPS, etc.
Send for our 1931 catalog.
"The House of a Thousand Bargains"
DeWITT TOOL CO.
244 Lafayette St., New York, N. Y.

WANTED

Bolt Cutters—½-in. Landis Double Head, 1-in. Landis Single Head with lead screw, 2½-in. Acme Single Head with lead screw.

Boring Mills—24-in. Bullard Prod. Type, 42-in. Bullard "New Era", 42-in. Gisholt vert.

Boring Bar—2½-in. Cleveland, 2½-in. Lucas, No. 5-D Moline 6 sp. cyl. borer.

Drills—No. 0, ½, 1, and 2 Avey B.B., Leland-Gifford 2 and 3 sp. B.B., No. 1 Avey 6 sp. B.B., 20 in. 3-sp. Barnes self oiler, 24-in. Cincinnati sl. head tapping att., 34-in. Barnes sl. head.

Drills, Radial—2½-ft. American, 2½-ft. Mueller, 3-ft. American Triple Purpose M.D., 5-ft. Cin.-Bickford Univ.

Grinders—No. 11 B&S, 4x32-in. Pl., No. 11 B&S 6x32-in. Pl., 10x36-in. Norton, No. 16 B&S 10x72-in. Pl., 16x72-in. Norton Crankshaft, No. 1 Diamond Surface, No. 1½ Cincinnati Tool & Cutter.

Hobbers—No. 3 and No. 12 Barber-Colman.

Lathes—24-in.x16-ft. L. & S., 30-in.x14-ft. Schumacher & Boye, 33-in.x16-ft. LeBlond, 20-in.x18-ft. Sidney.

Millers—No. 2½-B K&T Vert. No. 5-B Becker Vert., No. 2 Cinti. Univ., No. 3 Cincinnati Universal S.P.D., No. 1 Kempsmith Pl., No. 2 Cincinnati Pl., No. 3 Sundstrand Rigidmil.

Pipe Machines—6-in. Landis, 6-in. E.C.B.

Presses—Nos. 18, 19, 20 and 21½ Bliss O.B.I., No. 0 Verson, No. 1 and No. 4 Loshbough & J., No. 165-B Consolidated DBL Crank, No. 102 Consolidated DBL Crank.

Screw Machines—Nos. 5 and 6 Wood tilted turret, Nos. 0 and 1 Foster, No. 2 W&S, Nos. 3 and 7 Foster, Nos. 52 and 53 Nat. Acme 4 spdle.

Shapers—16 in. Rockford, 20-in. Smith & Mills, 32-in. Columbia.

Turret Lathes—No. 1-B Foster, No. 1-A Warner & Swasey.

THE E. L. ESSLEY · MACHINERY · CO
555 W. Washington Blvd., Chicago, Ill.
412 No. Plankinton Ave., Milwaukee, Wis.

FOR SALE

CINCINNATI 18" Automatic Plain Miller

GENERAL MACHINERY CORPORATION
"The Machine Tool Merchants"
140 Federal Street, Boston, Mass.

WANTED

Sliding Bed Gap Lathe or Double Spindle Lathe (Two in one) size 48 x 26 in. x 12 ft. Must be in first-class condition, arranged for Belt Drive and with all the usual equipment. Give full details.

W-49, American Machinist
Tenth Ave. at 36th St., New York City

FOR SALE

BALING PRESS and PUMP

1—80-ton Watson-Stillman.

FS-39, American Machinist
Tenth Ave. at 36th St., New York City

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SEARCHLIGHT SECTION of *American Machinist*

SELL for CASH the machinery you are replacing or that which is no longer needed in your plant.

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Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

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COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL 10 A. M. FRIDAY FOR THE ISSUE OUT THE FOLLOWING THURSDAY A.M.

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Rebuilt Machines

Universal horizontal boring mill.
2M Potter & Johnson automatic milling machines.
Ohio (Osterlein) Rotary tilted table mill.
30 in. Gisholt single head boring mill.
Taylor & Fenn vertical mill.
Becker duplex miller.
No. 11 Natco multi-spindle drill—round head.
No. 55 Atlas 10-ton power arbor press.
Acme 2-spindle ½ in. bolt cutter.
Rickert & Shafer automatic threaders.
No. 52 National Acme screw machine.
No. 18 American vertical broaches.
Newton rotary mills.
10x36 Norton Grinders.
LeBlond tool and cutter grinder.
Gorton disc grinders.
9x12 Sundstrand manufacturing lathes.
9x14 Porter-Cable manufacturing lathes.
12x6 Seneca Falls tool room lathe.
Jones & Lamson turret lathes.

PALMER-EDWARDS CO.
906 Leith St., Flint, Mich.

UNIVERSAL MILLERS

No. 1 Cleveland.
No. 2 Kempsmith.
No. 2 Cincinnati.
No. 2A Brown & Sharpe.
No. 3 Kempsmith.
No. 3 Ohio (Oesterlein).

SURFACE GRINDERS

Nos. 10 and 16 Blanchard.
No. 2 Brown & Sharpe.
14x40 in. Pratt & Whitney.
20x50-in. Safety Emery Wheel Co.
12-in. and 16-in. Heald Rotary.
12-in. Arter Rotary.

RADIAL DRILLS

3, 4, 5, 6 and 8-ft. Western.
3-ft. and 4-ft. American.
3-ft. and 4-ft. Mueller.
3-ft. Cincinnati Bickford.
6-ft. Niles Bement Pond Univ.

PRESSES

No. 165 Toledo toggle.
No. 67 Consolidated tie rod.
No. 205C Toledo double crank.
No. 56 Toledo S.S.
No. 6 Adriance OBI.
No. 41 Toledo horning

MILES
MACHINERY COMPANY
SAGINAW, W.S.
MICHIGAN

POSITIONS VACANT

Massachusetts

FOREMAN machinist. First-class man wanted for a machine shop. State age, experience, former employers and salary expected. Replies held strictly confidential. P-48, American Machinist, Tenth Ave., at 36th St., New York.

Rhode Island

A COMPANY manufacturing textile machinery has a position for a man of inventive capabilities. One who can develop and put his ideas into workable form required. Give full information in reply. Address P. O. Box 1513, Providence, R. I.

DRAFTSMAN familiar with modern designs of looms for weaving woolen materials. P-38, American Machinist, Tenth Ave. at 36th St., New York.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000 and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established twenty-one years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 266 Main Street, Buffalo, New York.

SINCE 1919, Managers, Superintendents, other important men in machinery and metal trades have retained us. Individual. Confidential. Businessmen throughout metal working industries know us, believe in us. Jacob Penn, Incorporated, 535 Fifth Avenue, New York.

Notice To Advertisers!

Owing to the Holiday, New Year's Day, Jan. 1st, the "*Searchlight*" pages of Jan. 1st issue of

AMERICAN MACHINIST

will close one day in advance of the regular schedule.

Advertisers' cooperation in sending new advertisements or changes of copy early will be appreciated.

Final Closing Time

Display Ads
Wednesday, Dec. 24th.

EMPLOYMENT AGENCY

AMERICAN ENGINEERS SERVICE, Harrisburg, Pa., require for employment proposals: machine tool production engineers, automatic machinery, tool designers, shop draftsmen. Tool salesmen. Metallurgist. Estimators. Shop foremen, forgings, tools, specialties.

POSITIONS WANTED

FACTORY manager, production manager superintendent or sales; broad experience, capable mechanic and executive, open for new connection after Dec. 15-30. Location immaterial; best of references. PW-44, American Machinist, Tenth Ave. at 36th St., New York.

INSPECTOR, 32 years of age, 10 yr. experience as machinist, 4 yr. experience inspector. PW-18, American Machinist, Tenth Ave. at 36th St., New York.

SALES engineer — with a background, of 22 years' practical experience. Seven years' devoted to selling, in the capacity of direct branch manager, for well known firm, 38 years of age, married, American, protestant. Desires making a connection, in the capacity of branch manager, assistant to sales manager, or direct district representative. Reference if desired. Service should appeal to manufacturer appreciating results attained in having representation capable of solving the customer's problem on the ground. PW-29, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

INSPECTOR, 21, 4 yrs. experience practical and technical training. Also junior drafting or tracing pumping machinery. PW-46, American Machinist, Tenth Ave. at 36th St., New York.

SUPERINTENDENT or general foreman, 20 years practical and technical training modern machine shop production methods including assemblies. Ingenious in design of fixtures, tools and dies. Record of results. Available any location. PW-27, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

TOOL-ROOM foreman, 17 years practical experience, 5 years supervision, tool designing, special machinery and maintenance, wide experience on production. PW-47, American Machinist, Tenth Ave. at 36th St., New York.

YOUNG American, graduate of Technical School, Vienna, one year practical experience in drafting and layout work, wishes position. PW-45, American Machinist, Tenth Ave. at 36th St., New York.

AGENCY WANTED

Manufacturers Representative

Soliciting metal working plants in Northern Ohio, established eight years, desirable connections in largest industries. Specializing on three lines now. Want another reputable small tool line on commission basis. AW-34, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

AGENTS WANTED

Shop Agents Wanted

For our Tungsten Carbide Scribers. Will mark on hardened steel. Every tool or die maker needs one. McIntyre & Kerr, 1741 Eighth St., Berkeley, California.

PATENT ATTORNEYS

PATENTS — Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

BUSINESS OPPORTUNITY

COMPLETELY EQUIPPED CONTRACT MACHINE SHOP AND FOUNDRY

Located in one of the larger river towns on the lower Mississippi River. Glass and steel two-story building 80x100 with vacant lot running to next street suitable for railroad spur. Operated under same name for over thirty years. Must be sold to settle estate.

BO-59, American Machinist
520 No. Michigan Ave., Chicago, Ill.

WHAT AND WHERE TO BUY

A Classified Index of Advertisers in This Issue

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *American Machinist* assumes no responsibility for errors or omissions.

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Norton Co., Worcester, Mass.

ACCUMULATORS, Hydraulic
Elmes Engring Works, Chas. F., Chicago
Watson-Stillman Co., N. Y.

AIR Cushions for Power Presses
Marquette Tool & Mfg. Co., Chicago

ANGLE Plates
United States Automatic Box Machinery Co., Newtonville, Boston

ARBORS and Mandrels
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cushman Chuck Co., Hartford
Nicholson & Co., Wilkes-Barre, Pa.
Sundstrand Mach. Tool Co., Rockford, Ill.
Union Twist Drill Co., Athol, Mass.

BABBITT Metal
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

BALANCING Ways
Anderson Bros. Mfg. Co., Rockford, Sundstrand Mach. Tool Co., Rockford, Ill.

BALLS, Brass, Bronze & Steel
Auburn Ball Bearing Co., Rochester.
New Departure Mfg. Co., Bristol.

BEARINGS, Ball
Auburn Ball Bearing Co., Rochester
Bantam Ball Bearings Co., South Bend
New Departure Mfg. Co., Bristol.
Norma-Hoffmann Bearings Corp., Stamford
Torrington (Conn.) Co.

BEARINGS, Oilless or Self Oiling
Johnson Carlyle Machine Co., Manchester, Conn.

BEARINGS, Roller
Bantam Ball Bearings Co., South Bend
Norma-Hoffmann Bearings Corp., Stamford
Timken Roller Bearing Co., Canton

BEARINGS, Thrust
Norma-Hoffmann Bearings Corp., Stamford
Timken Roller Bearing Co., Canton, O.

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BENCHES and Bench Legs
New Britain-Gridley Mach. Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING and Straightening Machines
Buffalo (N. Y.) Forge Co.
Cincinnati (O.) Shaper Co.
Consolidated Mach. Tool Corp. of Amer., Rochester
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.
Wickes Bros., Saginaw, Mich.

BITS, Tool
(See Tool Bits)

BLOCKS, Pillow
(See Pillow Blocks)

BLOWERS and Fans
American Gas Furnace Co., Elizabeth, N. J.
Buffalo (N. Y.) Forge Co.

BLUE Printing Machinery
Wickes Bros., Saginaw, Mich.

BOLT and Nut Machinery
Acme Mchy. Co., Cleveland
Foote-Burt Co., Cleveland
Landis Machine Co., Waynesboro.
National Acme Co., Cleveland
National Machinery Co., Tiffin, O.

BOLTS and Nuts
(See also Lock-nuts)
National Acme Co., Cleveland

BOOKS, Technical
McGraw-Hill Book Co., N. Y.

BORING and Turning Mills, Vertical
Bullard Co., Bridgeport, Conn.
Consolidated Mach. Tool Corp. of Amer., Rochester
Sellers & Co., Wm., Philadelphia

BORING, Drilling and Milling Machines Horizontal
Barnes Co., W. F. & John, Rockford
Consolidated Mach. Tool Corp. of Amer., Rochester
Defiance (O.) Machine Works.
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Moline (Ill.) Tool Co.
Rockford (Ill.) Drilling Mach. Co.
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Wm., Philadelphia
Springfield (O.) Mch. Tool Co.

BORING, Drilling and Milling Machines, Vertical
Ferner Co., R. Y., Washington
Universal Boring Machine Co., Hudson, Mass.

BORING Bars and Heads
Davis Boring Tool Co., St. Louis

BORING Machines, Car Wheel
Sellers & Co., Wm., Philadelphia

BORING Machines, Locomotive Driving Box
Sellers & Co., Wm., Philadelphia

BORING Tools
Armstrong Bros. Tool Co., Chicago
Davis Boring Tool Co., St. Louis

BOXES, Tote
(See Furniture Mach. Shop)

BRAKES, Magnetic
Cutler-Hammer, Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

BROACHING Machines
Perkins Machine & Gear Co., Springfield, Mass.

BUFFING & Polishing Machines
(See Polishing & Buffing Machines)

BURNERS, Oil and Gas
Hones, Chas. A., Baldwin, L. I. N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa

BUSHINGS, Drill and Jig
Acme Industrial Co., Chicago
Ex-Cell-O Aircraft & Tool Corp., Detroit
Universal Engineering Co., Frankenmuth

CABINETS, Tool, Reamer & Drill; Steel
(See Furniture, Machine Shop)

CALIPERS
Brown & Sharpe Mfg. Co., Providence
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

CAM Cutting Machines
Rowbottom Mach. Co., Waterbury.

CAMS
Hartford (Conn.) Special Machy. Co.
Rowbottom Mach. Co., Waterbury.

CARBURIZING Machines
American Gas Furnace Co., Elizabeth, N. J.

CASE Hardening and Tempering Compounds
Meisel Press Mfg. Co., Boston
Shore Instrument & Mfg. Co., Jamaica, N. Y.

CASTINGS, Iron and Semi-Steel
Etna Machine Co., Toledo
Springfield (O.) Mach. Tool Co.

CENTERING Machines
Hanson-Whitney Machine Co., Hartford
Pratt & Whitney Co., Hartford
Sundstrand Mach. Tool Co., Rockford, Ill.
Whiton Mach. Co., D. E., New London, Conn.

CHAINS
(See Sprockets & Chains)

CHAINS, Transmission
Boston Gear Works Sales Co., Quincy, Mass.
Philadelphia (Pa.) Gear Wks.

CHECKS, Metal, Time and Tool
Noble & Westbrook Mfg. Co., Hartford

CHUCKING Machines
Bullard Co., Bridgeport, Conn.
Cleveland (O.) Automatic Mach. Co.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt
Kingsbury Machine Tool Corp., Keene, N. H.
National Acme Co., Cleveland
New Britain-Gridley Mach. Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Automatic and Quick Changing
Errington Mech. Laboratory, S. I. N. Y.
Geometric Tool Co., New Haven.
Jarvis Co., Chas. L., Gildersleeve, Conn.
National Tool Co., Cleveland

CHUCKS, Collet
Sundstrand Mach. Tool Co., Rockford, Ill.

CHUCKS, Drill and Tap
Cushman Chuck Co., Hartford
Errington Mech. Lab., S. I., N. Y.
Jarvis Co., Chas. L., Gildersleeve, Conn.
Whiton Mach. Co., D. E., New London, Conn.

CHUCKS, Full Floating
Errington Mech. Laboratory, S. I. N. Y.

CHUCKS, Lathe
Bullard Co., Bridgeport, Conn.
Cushman Chuck Co., Hartford
Whiton Mach. Co., D. E., New London, Conn.

CHUCKS, Magnetic
Heald Machine Co., Worcester, Mass.

CHUCKS, Split
Seneca Falls (N. Y.) Machine Co.

CHUCKS, Vertical Boring Mill
Bullard Co., Bridgeport.
Whiton Machine Co., D. E., New London, Conn.

CLAMPS, Machinists'
Armstrong Bros. Tool Co., Chicago
Starrett Co., L. S., Athol, Mass.

CLEANERS, Compounds
Oakite Products, Inc., N. Y

CLEANING Machines, Metal Parts
Colts Patent Fire Arms Mfg. Co., Hartford

CLUTCHES, Friction
Brown Eng. Co., Reading, Pa.
Cutler-Hammer Mfg. Co., Milwaukee
Johnson Machine Co., Carlyle, Manchester, Conn.
Jones Fdry. & Mach. Co., W A., Chicago

COLLARS, Spacing
Detroit (Mich.) Stamping Co.

COLLETS
Brown & Sharpe Mfg. Co., Providence
Geometric Tool Co., New Haven.
Rivett Lathe & Grinder Corp., Brighton, Boston
Union Twist Drill Co., Athol, Mass.

COMPOUNDS, Cutting, Drawing Grinding and Screw Cutting
Oakite Products, N. Y.

COMPOUNDS, Resin
Bakelite Corp., N. Y. C.

COMPRESSORS—Air & Gas
Black & Decker Mfg. Co., Towson, Md.

CONTRACT Work
American Metal Treatment Co., Elizabeth, N. J.
Brown & Sharpe Mfg. Co., Providence
Bunell Machine & Tool Co., Cleveland
Columbus (O.) Die T. & M. Co.
Detroit (Mich.) Stamping Co.
Hartford (Conn.) Special Machy. Co.
Johnson Carlyle Machine Co., Manchester, Conn.
Langelier Mfg. Co., Providence
Lincoln Mach. Co., Pawtucket, R. I.
Meisel Press Mfg. Co., Boston
Moore Special Tool Co., Bridgeport
Nicholson & Co., W. H., Wilkes-Barré, Pa.
North Wales (Pa.) Mach. Co.
Precision Engr. Co., Phila.
Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Ampere, N. J.
Wade Tool Co., Waltham, Mass.
Waltham (Mass.) Mach. Wks.
Watson-Stillman Co., N. Y. C.

CONTROLLERS & Starters, Electric
Cutler-Hammer Mfg. Co., Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

CONVERTORS
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

COUNTERBORES
National Tool Co., Cleveland
Slocomb Co., J. T., Providence

COUNTERS, Revolution
Veeder-Root, Hartford

COUNTERSHAFTS
Rivett Lathe & Grinder Corp., Brighton, Boston
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
American Swiss File & Tool Co., Elizabeth

COUNTING Machines
Veeder-Root, Hartford

COUPLINGS, Flexible
Boston Gear Works Sales Co., Quincy, Mass.
Brown Eng. Co., Reading, Pa.
Jones Fdry. & Mach. Co., W. A., Chicago
Nicholson & Co., W. H., Wilkes-Barre
Philadelphia (Pa.) Gear Wks.

CUTTERS, Gear
Brown & Sharpe Mfg. Co., Providence
O. K. Tool Co., Shelton, Conn.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Keyseater
Davis Keyseater Co., Rochester

CUTTERS, Milling
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence
Butterfield & Co. (Divi. of Union Twist Drill Co.) Derby Line Vt.)
Geometric Tool Co., New Haven.
Ingersoll Milling Mach. Co., Rockford, Ill.
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Co., Hartford
Union Twist Drill Co., Athol, Mass.

CUTTING-OFF Machines
Brown & Sharpe Mfg. Co., Providence
Etna Machine Co., Toledo, O.
Landis Mach. Co., Waynesboro, Pa.

CUTTING-OFF Tools
(See Tools, Cutting-off)

DEALERS, Machinery
(See Searchlight Section)
Delta Equipment Co., Philadelphia
De Witt Tool Co., N. Y. C.
Eastern Mchy. Co., Cincinnati
Emerman & Co., L. E., Chicago
Essley Mchy. Co., E. L., Chicago
General Mchy. Corp., Boston
Hill, Clarke & Co., Chicago
Hyman & Sons, J., Phila.
Lang Machy. Co., Pittsburgh
Miles Machy. Co., Saginaw
Morey & Co., Inc., N. Y. C.
Osborne & Sexton Mchy. Co., Columbus
Palmer-Edwards Co., Flint, Mich.
Simmons Mach. Tool Corp., Albany
Standard Mchy. & Supply Co., Boston

DIE Cushions, Pneumatic
Marquette Tool & Mfg. Co., Chicago

DIE Cutting Machines,
Gorton Mach. Co., Geo., Racine.
Keller Mech. Engr. Corp., Brooklyn
Oliver Instrument Co., Adrian, Mich.

Die Holders for Presses
U. S. Tool Co., Ampere, N. J.

DIE Makers Supplies
Danly Mach. Spec., Inc., Chicago
U. S. Tool Co., Ampere, N. J.

DIEING Machines
Henry & Wright Mfg. Co., Hartford

DIE Making Machines
Haskins Co., R. G., Chicago
Keller Mech. Engr. Corp., Brooklyn
Reed-Prentice Corp., Worcester

DIE Sets
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Spec., Inc., Chicago
U. S. Tool Co., Ampere, N. J.

DIES, Adjustable, Self Opening
Eastern Mach. S. Corp., New Haven.
Errington Mech. Laboratory, S. I. N. Y.
Geometric Tool Co., New Haven.
Jones & Lamson Mach. Co., Springfield, Vt
Landis Mach. Co., Waynesboro, Pa.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Machy. Co., Tiffin, O.

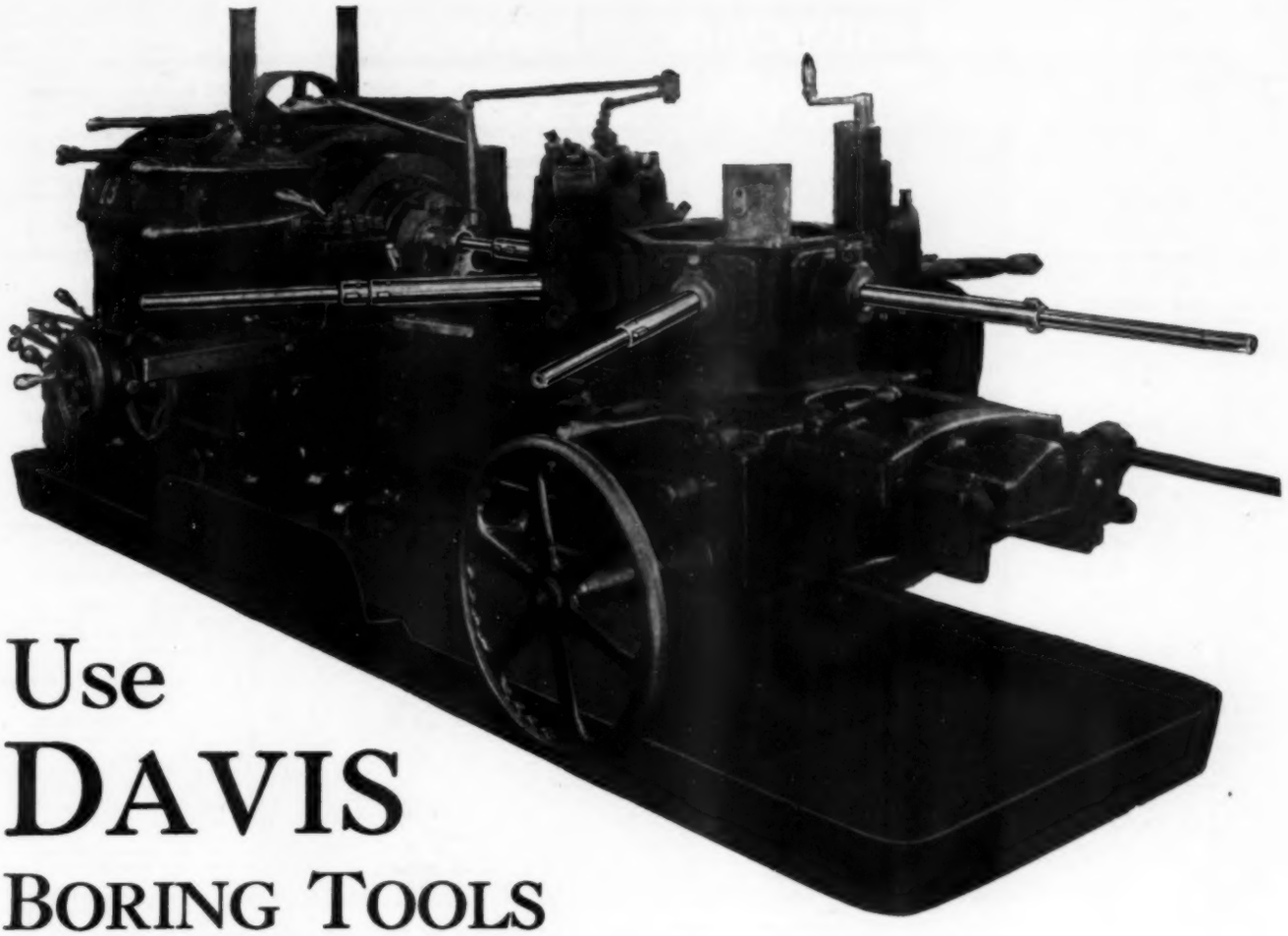
DIES, Forging
Butterfield & Co. (Divi. of Union Twist Drill Co.), Derby Line, Vt.
Keller Mech. Engr. Corp., Brooklyn

DIES, Sheet and Sub Press
(See Contract Work)

DIES, Steel Marking
Noble & Westbrook Mfg. Co., Hartford

DIVIDING Heads
Carl Zeiss, (Geo. Scherr Co.), N. Y.

DOGS, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago



Use DAVIS BORING TOOLS to Increase Production!

PROBABLY you, too, can increase your production on parts to be bored, as Majonnier Brothers Company, Chicago, did, with Davis Boring Tools.

In 23 minutes, they made two rough and two finished bores on a steel casting, as shown above, on a No. 2-A Warner & Swasey Turret Lathe equipped with two Davis Standard "L" Type Tools and two Davis Combination "L" Type Tools, a saving of several hours over former methods.

Send us your blue prints or samples of boring and reaming jobs, and let our engineers tell you how we would do it with Davis Rapid Production Tooling.

Davis Boring Tool Company

6200 MAPLE AVE., ST. LOUIS, MO.

DRESSERS, Grinding Wheel
Desmond-Stephan Mfg. Co. Urbana, O.
Norton Co., Worcester, Mass.

DRILL and Tap Heads, Multiple
Errington Mech. Laboratory, S. I. N. Y.
Hoefer Mfg. Co., Freeport, Ill.

DRILLING Machine Heads
Rockford (Ill.) Drilling Machine Co.
U. S. Drill Head Co., Cincinnati

DRILLING Machines
Kingsbury Machine Tool Corp., Keene, N. H.

DRILLING Machines, Automatic and Semi-Automatic
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Bradford Mach. Tool Co., Cincinnati
Kingsbury Machine Tool Corp., Keene, N. H.
Rockford (Ill.) Drilling Machine Co
Sundstrand Mach. Tool Co., Rockford, Ill.

DRILLING Machines, Bench
Ames Co., B. C., Waltham, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Canedy-Otto Mfg. Co., Chicago H'ghts, Ill.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Rockford (Ill.) Drilling Mach. Co

DRILLING Machines, Gang
Baker Bros., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Henry & Wright Mfg. Co., Hartford
Rockford (Ill.) Drilling Machine Co.

DRILLING Machines, Heavy Duty
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Consolidated Mach. Tool Corp. of Amer., Rochester
Foote-Burt Co., Cleveland
Minster Machine Co., Minster, O.
Rockford (Ill.) Drilling Machine Co
Ryerson & Son, Jos. T., Chicago

DRILLING Machines, Horizontal
(See Boring, Drilling & Milling Machines, Horizontal)
Baker Bros., Toledo

DRILLING Machines, Horizontal, One Way
Kingsbury Machine Tool Corp., Keene, N. H.

DRILLING Machines, Radial
American Tool Wks. Co., Cincinnati
Carlton Machine Tool Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Morris Mach. Tool Co., Cincinnati
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Wm., Philadelphia

DRILLING Machines, Sensitive
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo (N. Y.) Forge Co.
Canedy-Otto Mfg. Co., Chicago H'ghts, Ill.
Henry & Wright Mfg. Co., Hartford
High Speed Hammer Co., Rochester.
Kingsbury Mach. Tool Corp., Keene, N. H.
Langelier Mfg. Co., Providence
Leland-Gifford Co., Worcester, Mass.
Taylor & Fenn Co., Hartford

DRILLING Machines, Turret
Kingsbury Machine Tool Corp., Keene, N. H.

DRILLING Machines, Upright Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Consolidated Mach. Tool Corp. of Amer., Rochester
Foote-Burt Co., Cleveland
Fox Machine Co., Jackson, Mich.
Grant Mfg. & Mach. Co., Bridgeport
Henry & Wright Mfg. Co., Hartford
Kingsbury Mach. Tool Corp., Keene, N. H.
Moline (Ill.) Tool Co.
Pratt & Whitney Co., Hartford
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia

DRILLING Machines, Vertical
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Canedy-Otto Mfg. Co., Chicago H'gts
Cincinnati (O.) Bickford Tool Co
Foote-Burt Co., Cleveland
Henry & Wright Mfg. Co., Hartford
Leland-Gifford Co., Worcester, Mass.
Rockford (Ill.) Drilling Mach. Co.

DRILLS, Center
Slocomb Co., J. T., Providence
Union Twist Drill Co., Athol, Mass.

DRILLS, Portable, Elec. and Pneumatic
(See Portable Tools)
Black & Decker Mfg. Co., Towson, Md.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Standard Elect. Tool Co., Cincinnati

DRILLS, Ratchet
Armstrong Bros. Tool Co., Chicago
Union Twist Drill Co., Athol, Mass.

DRILLS, Twist and Flat
Butterfield & Co. (Divi. of Union Twist Drill Co.), Derby Line, Vt.
Union Twist Drill Co., Athol, Mass.

ELECTRICAL Instruments
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

ELECTRICAL Supplies
Cutler-Hammer Mfg. Co., Milwaukee
Simplex Wire & Cable Co., Boston
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

ELEVATOR Trucks
(See Trucks)

ENGRAVING Machinery
Gorton Mach. Co., Geo., Racine.
Preis & Co. H. P., Newark, N. J.

EXTRACTORS, Oil
Barrett Leon J., Worcester, Mass.

EYE Glasses, Safety
(See Goggles, Safety)

FANS, Electric
Buffalo (N.Y.) Forge Co.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

FILES, Precision
American Swiss File & Tool Co., Elizabeth

FILING Machines
Ames Co., B. C., Waltham, Mass.
Haskins Co., R. G., Chicago
Oliver Instrument Co., Adrian, Mich.

FILLER, Iron
(See Cement Iron)

FILTERS, Oil
(See Oil Filtering)

FITTINGS, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

FLEXIBLE Shaft Equipment
Keller Mech. Engr. Corp., Brooklyn
Strand & Co., N. A., Chicago

FORGING Machinery
Acme Mchy. Co., Cleveland
National Mchy. Co., Tiffin, O.

FORMING Attachment, Press
Marquette Tool & Mfg. Co., Chicago

FURNACES, Electric
American Electric Furnace Co., Boston
Electric Furnace Co., Salem, O.
Sentry Co., Taunton, Mass.
Strong, Carlisle & Hammond Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

FURNACES, Forging
American Electric Furnace Co., Boston
American Gas Furnace Co., Elizabeth, N. J.
Hones, Chas. A., Baldwin, L. I. N. Y.
Sentry Co., Taunton, Mass.
Strong, Carlisle & Hammond Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

FURNACES, Heat Treating, Tempering and Annealing
American Electric Furnace Co., Boston
American Gas Furnace Co., Elizabeth, N. J.
Electric Furnace Co., Salem, O.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Sentry Co., Taunton, Mass.
Strong Carlisle & Hammond Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

FURNACES, Oil & Gas
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Strong, Carlisle & Hammond Co., Cleveland

FURNACES, Soldering
Hones, Chas. A., Baldwin, L. I. N. Y.

FURNITURE, Machine Shop
Brown Eng. Co., Reading, Pa.
New Britain-Gridley Mach. Co., New Britain, Conn.

GAGE Blocks
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Comparators
Federal Products Corp., Providence
Jones & Lamson Mch. Co., Springfield, Vt.

GAGES, Dial
Ames, Co., B. C., Waltham, Mass.
Federal Products Corp., Providence
Standard Gage Co., Inc Poughkeepsie
Starrett Co., L. S., Athol, Mass.

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence
Hanson-Whitney Machine Co., Hartford
Pratt & Whitney Co., Hartford
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Hanson-Whitney Machine Co., Hartford
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Standard
Federal Products Corp., Providence
Hanson-Whitney Machine Co., Hartford
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GEAR Blanks, Composition
Bakelite Corp., N. Y. C.

GEAR Burnishing Machines
Gleason Works, Rochester

GEAR Cutting Machinery
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Bilgram Machine Works, Phila.
Brown & Sharpe Mfg. Co., Providence
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Newark Gear Cutting Machine Co., N. J.
Schuchardt & Schutte (Geo. Scherr Co., N. Y.
Waltham (Mass.) Machine Works
Whiton Mch. Co., D. E., New London, Conn.

GEAR Tempering Machinery
Gleason Works, Rochester, N. Y.

GEAR Testing Machinery
Ferner Co., R. Y., Washington
Gleason Works, Rochester, N. Y.
Newark Gear Cutting Machine Co., N. J.

GEARS, Cast
Cleveland (O.) Worm & Gear Co.
Grant Gear Works, Boston
Hartford (Conn.) Special Machy. Co.
Philadelphia (Pa.) Gear Works

GEARS, Cut
Adams Co., Dubuque, Iowa
Atlantic Gear Works, Brooklyn
Bilgram Machine Works, Phila.
Boston Gear Works Sales Co., Quincy, Mass.
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Worm & Gear Co.
Diefendorf Gear Corp., Syracuse
Earle Gear & Mch. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Grant Gear Works, Boston
Hartford (Conn.) Special Machy. Co.
Johnson Carlyle Machine Co., Manchester, Conn.
Jones Fdry. & Mach. Co., W. A., Chicago
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia, (Pa.) Gear Works
Simonds Mfg. Co., Pittsburgh

GENERATORS, Electric
Reliance Elect. & Eng. Co., Cleveland

GREASE Cups
(See Oil & Grease Cups)

GRINDING Machines, Ball Bearing Race
(See Grinding Machines, Radial)

GRINDING Machines, Bench
Blount Co., J. G., Everett, Mass.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Haskins Co., R. G., Chicago
Norton Co., Worcester, Mass.
Union Twist Drill Co., Athol, Mass.
Walls Sales Corp., N. Y. C.

GRINDING Machines Centerless
Cincinnati (O.) Grinders, Inc.

GRINDING Machines, Chaser
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro
National Acme Co., Cleveland

GRINDING Machines, Chucking
Blanchard Mach. Co., Cambridge
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester.

GRINDING Machines Cutter and Tool
Barber-Colman Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati (O.) Milling Mach. Co
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gorton Mach. Co., Geo., Racine.
Heald Mach. Co., Worcester, Mass.
LeBlond Mach. Tool Co., R. K., Cincinnati
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Wm., Philadelphia
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol, Mass.

GRINDING Machines, Cylinder
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester.
Micro Machine Co., Bettendorf, Iowa
Norton Co., Worcester, Mass.

GRINDING Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Grinders Co.
Heald Machine Co., Worcester.

GRINDING Machines, Die
Abrasive Mch. T. Co., E. Providence
Bignall & Keeler Mach. Wks., Edwardsville, Ill.
Blanchard Mach. Co., Cambridge
Bryant Chucking Grinder Co., Springfield, Vt.
Geometric Tool Co., New Haven.
Heald Machine Co., Worcester.
Landis Machine Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Machinery Co., Tiffin, O.

GRINDING Machines, Drill and Tap
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Sellers & Co., Wm., Philadelphia

GRINDING Machines, Face or Ring Wheel
Abrasive Mch. T. Co., E. Providence
Blanchard Mach. Co., Cambridge.
Diamond Mach. Co., Providence

GRINDING Machines, Flexible Shaft
Haskins Co., R. G., Chicago
Keller Mech. Engr. Co., Brooklyn

GRINDING Machines, Floor, no feed attachments
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Diamond Mach. Co., Providence
Norton Co., Worcester, Mass.

GRINDING Machines, Gage
Abrasive Mch. T. Co., E. Providence
Ferner Co., R. Y., Washington

GRINDING Machines, Hob
Schuchardt & Schutte (Geo. Scherr Co.), New York

GRINDING Machines, Internal
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Cincinnati
Heald Mach. Co., Worcester, Mass.
Hjorth Lathe & Tool Co., Boston
Micro Machine Co., Bettendorf, Iowa
Rivett Lathe & Grinder Corp., Brighton, Boston

GRINDING Machines, Piston Ring
Heald Machine Co., Worcester.

GRINDING Machines, Portable Electric & Pneumatic
Black & Decker Mfg. Co., Towson, Md.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Haskins Co., R. G., Chicago
Van Dorn Electric Tool Co., Cleveland

GRINDING Machines, Surface
Abrasive Mch. T. Co., E. Providence
Blanchard Mach. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Diamond Mach. Co., Providence
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Heald Mach. Co., Worcester, Mass.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Hartford

GRINDING Machines, Swing frames or Snagging
Blount Co., J. G., Everett, Mass.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Diamond Mach. Co., Providence
Norton Co., Worcester, Mass.

GRINDING Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati Grinders, Cincinnati
Gallmeyer & Livingston Co., Grand Rapids, Mich.
LeBlond Mach. Tool Co., R. K., Cincinnati
Norton Co., Worcester, Mass.

GRINDING Wheel Dressers
American Swiss File & Tool Co., Elizabeth

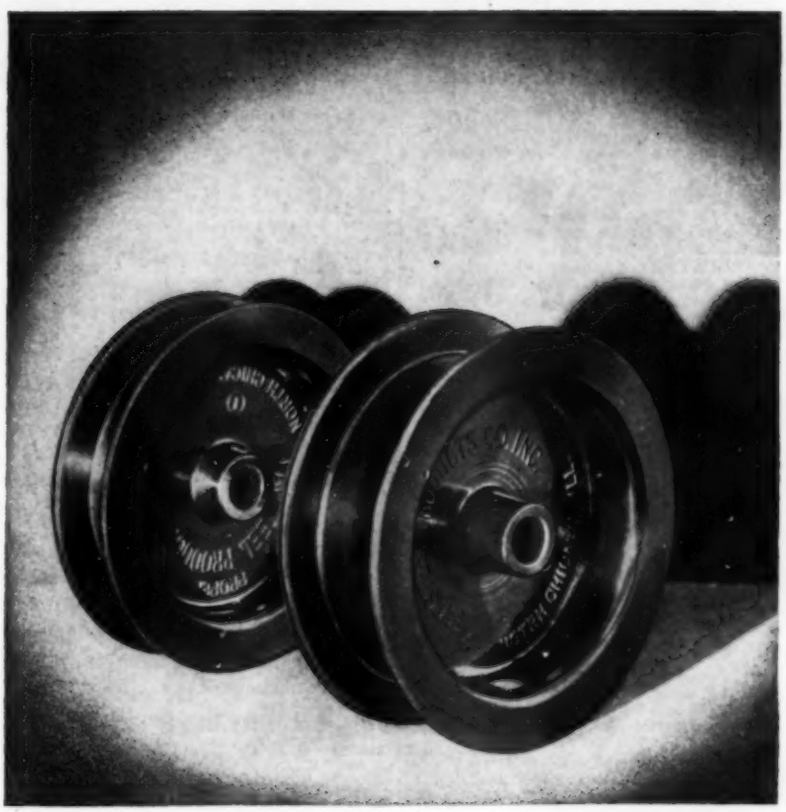
GRINDING Wheels
Norton Co., Worcester, Mass.

HAMMERS, Power
Bliss Co., E. W., Brooklyn, N. Y.
High Speed Hammer Co., Rochester.
Sellers & Co., Wm., Philadelphia

HANGERS, Shaft
Jones Fdry. & Mach. Co., W. A., Chicago
Standard Pressed Steel Co., Jenkintown, Pa.

HARDNESS Measuring Instruments, Steel
Shore Instrument & Mfg. Co., Jamaica, N. Y.
Wilson-Maeulen Co., N. Y. C.

HEATERS, Rivet
American Gas Furnace Co., Elizabeth, N. J
Buffalo (N. Y.) Forge Co.



Bakelite Molded wire spools, used by Fansteel Products Company, Inc., N. Chicago, Ill.

HOW THIS SPOOL DESIGN WAS IMPROVED

AT A 60 PERCENT SAVING IN COST

Light weight was one of the essentials for the Fansteel wire spools, so they were formerly made of Aluminum. A desire to improve the design and appearance of these spools led to the adoption of Bakelite Molded, which also proved to be advantageous in other respects.

Eight of the Bakelite Molded spools are formed in one press operation, at a saving in cost of 60% over the former method. In addition, Bakelite Molded was resistant to moisture and to temperature changes, easier to handle and to keep clean and much better in appearance.

Innumerable parts formerly machined from metal are now quickly and economically formed of Bakelite Molded. This material is incorrodible, and as a fine finish is acquired in the mold, no plating, enameling or lacquering is necessary.

Write to us for a copy of Booklet 34M, "Bakelite Molded", and read of the many ways in which this material is being successfully used.

Bakelite Engineering Service—We manufacture a wide variety of Bakelite resinoid molding materials, varnishes, lacquers, enamels, cements, and other products. Twenty years experience in the development of these materials for mechanical and other uses, provides a valuable back ground for the cooperation offered by our engineers and laboratories.

BAKELITE CORPORATION, 247 Park Avenue, New York. CHICAGO OFFICE, 635 West Twenty-second Street

BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario

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THE MATERIAL OF A THOUSAND USES

HOBBING Machines
Adams Co., Dubuque, owa
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence
Newark Gear Cutting Machine Co., N. J.
Schuchardt & Schutte (Geo. Scherr Co.), New York

HOBS
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence
Hanson-Whitney Machine Co., Hartford
National Tool Co., Cleveland
Philadelphia (Pa.) Gear Wks.
Union Twist Drill Co., Athol, Mass.

HOISTS, Portable
(See Cranes Portable)

HONING Machines
Barnes Drill Co., Rockford, Ill.

HYDRAULIC Machinery
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

ILLUMINATION, Industrial
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

INDICATORS, Dial
Federal Products Corp., Providence
Standard Gage Co., Inc., Poughkeepsie

INDICATORS, Speed and Test
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.
Veeder-Root, Hartford

JACKS, Planer
Armstrong Bros. Tool Co., Chicago

JIGS & Fixtures
(See Contract Work)

JOINTS, Universal
Boston Gear Works Sales Co., Quincy, Mass.
Gray & Prior Mach. Co., Hartford

KETTLES, Soda
Gray & Prior Mach. Co., Hartford

KEYSEATING Machines
Baker Bros., Toledo, O.
Davis Keyseater Co., Rochester
National Machine Tool Co., Cincinnati

KNURLS and Knurl Holders
American Swiss File & Tool Co., Elizabeth

LAMPS, Electric
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

LAPPING Machines, Cylindrical and Flat
Norton Co., Worcester, Mass.

LAPS and Hones
Brickner-Kropf Mach. Co., Muskegon Hghts., Mich.

LATHE Attachments
Flather Co. (The) Nashua, N. H
South Bend (Ind.) Lathe Works

LATHE Tools
Armstrong Bros. Tool Co., Chicago
O. K. Tool Co., Shelton, Conn.

LATHES, Automatic and Semi-Automatic
Bradford Mach. Tool Co., Cincinnati
Bullard Co., Bridgeport, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Mach. Tool Co., Cincinnati
National Acme Co., Cleveland
Potter & Johnston Mch. Co., Pawtucket
Pratt & Whitney Co., Hartford
Reed-Prentice Corp., Worcester.
Seneca Falls (N. Y.) Machine Co
Sundstrand Mach. Tool Co., Rockford, Ill.

LATHES, Axle R.R.
Sellers & Co., Wm., Philadelphia

LATHES, Bench
Ames Co., B. C., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Hjorth Lathe & Tool Co., Boston
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Corp., Brighton, Boston
Seneca Falls (N. Y.) Machine Co.
South Bend (Ind.) Lathe Works

LATHES, Engine
American Tool Wks. Co., Cincinnati
Boye & Emmes Machine Tool Co., Cincinnati
Bradford Mach. Tool Co., Cincinnati
Consolidated Mach. Tool Corp. of Amer., Rochester
Flather Co. (The) Nashua, N. H.
Greaves-Klusman Tool Co., Cinn.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Mach. Tool Co Cincinnati
Monarch Mach. Tool Co., Sidney, O.
Morris Machine Tool Co., Cinn.
Pratt & Whitney Co., Hartford
Reed-Prentice Corp., Worcester.
Ryerson & Son, Jos. T., Chicago
Seneca Falls (N. Y.) Machine Co.
South Bend (Ind.) Lathe Works
Springfield (O.) Mch. Tool Co.
Sundstrand Mach. Tool Co., Rockford, Ill.
Wickes Bros., Saginaw, Mich.

LATHES, Horizontal and Vertical Turret
Brown & Sharpe Mfg. Co., Providence
Bullard Co., Bridgeport, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford
Warner & Swasey Co., Cleveland

LATHES, Polishing
(See Polishing and Buffing Machines)

LATHES, Spinning
Adriance Mach. Wks., Brooklyn

LATHES, Toolroom
American Tool Wks. Co., Cincinnati
Bradford Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Mach. Tool Co., Cincinnati
Pratt & Whitney Co., Hartford
Reed-Prentice Corp., Worcester
South Bend (Ind.) Lathe Works
Sundstrand Mach. Tool Co., Rockford, Ill.

LATHES, Wheel, R. R.
Sellers & Co., Wm., Philadelphia

LETTERS and Figures
Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVEL Precision Machines, Aligning
Ferner Co., R. Y., Washington
Universal Bor. Mach. Co., Hudson

LUBRICANTS
Oakite Products, N. Y.

LUBRICATING Systems
Rivett Lathe & Grinder Corp., Brighton, Boston

LUGS, Soldering and Terminal
Wolverine Tube Co., Detroit

MACHINISTS' Small Tools
American Swiss File & Tool Co., Elizabeth
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

MAGNETS, Lifting
Cutler-Hammer, Milwaukee
Ohio Elec. Mfg. Co., Cleveland

MANDRELS
(See Arbors and Mandrels)

MARKING Devices
(See Stamps, Steel)

MARKING Machines
Noble & Westbrook Mfg. Co., Hartford
Preis & Co., H. P., Newark, N. J.

MEASURING Instruments
Ferner Co., R. Y., Washington
Hanson-Whitney Machine Co., Hartford
Norma-Hoffmann Bearings Corp., Stamford
Carl Zeiss, (Geo. Scherr Co.), N. Y.

METAL, Monel
International Nickel Co., N. Y. C.

MELTING Pots
Hones, Chas. A., Baldwin, L. I. N. Y.

MICROMETERS
Brown & Sharpe Mfg. Co., Providence
Ferner Co., R. Y., Washington
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

MILLING Attachments
Adams Co., Dubuque, Iowa
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Reed-Prentice Corp., Worcester.
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Pratt & Whitney Co., Hartford
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Bench
Ames Co., B. C., Waltham, Mass.
Pratt & Whitney Co., Hartford
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Continuous
Consolidated Mach. Tool Corp. of Amer., Rochester
Ingersoll Milling Mach. Co., Rockford, Ill.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Duplex
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.

MILLING Machines, Floor Plate
Sellers & Co., Wm., Philadelphia

MILLING Machines, Hand
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Pratt & Whitney Co., Hartford
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Plain
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Planer Type
Consolidated Mach. Tool Corp. of Amer., Rochester
Ingersoll Milling Mach. Co., Rockford, Ill.
Sellers & Co., Wm., Philadelphia

MILLING Machines, Portable
Ingersoll Milling Mach. Co., Rockford, Ill.

MILLING Machines, Thread
Adams Co., Dubuque, Iowa
Hanson-Whitney Machine Co. Hartford
Pratt & Whitney Co., Hartford
Waltham (Mass.) Mach. Wks.

MILLING Machines, Traveling Work Table
Sellers & Co., Wm., Philadelphia

MILLING Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Vertical
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Consolidated Mach. Tool Corp. of Amer., Rochester
Gorton Mach. Co., Geo., Racine.
Ingersoll Milling Mach. Co., Rockford, Ill.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Reed-Prentice Corp., Worcester.
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLING Machines, Worm
Cleveland (O.) Automatic Mach. Co.
Pratt & Whitney Co., Hartford
Waltham (Mass.) Mach. Wks.

MOTORS, Electric
Ohio Elec. Mfg. Co., Cleveland
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

NICKEL
International Nickel Co., N. Y. C.

NUMBERING Machines
Noble & Westbrook Mfg. Co., Hartford

NUT Setters
Jarvis Co., Chas. L., Gildersleeve, Conn.

NUTS, Castellated
National Acme Co., Cleveland

NUT Setters, Pneumatic & Electric
Cincinnati Electrical Tool Co., Cincinnati, Ohio

OIL and Grease Cups
Gits Bros. Mfg. Co., Chicago

OIL Grooving Machines
Hanson-Whitney Mach. Co., Hartford
National Machine Tool Co., Cincinnati

OIL Stones
Norton Co., Worcester, Mass.

OILS
(See Lubricants)

PARALLELS
Starrett Co., L. S., Athol, Mass.

PATTERN Shop Machinery
(See Woodworking Machinery)

PILLOW Blocks
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE Cutting and Threading Machines
Bignall & Keeler Mach. Wks., Edwardsville, Ill.
Landis Machine Co., Waynesboro, Pa.
Murchey Mach. & Tool Co., Detroit

PIPE Fitters' Tools
Butterfield & Co. (Div. of Union Twist Drill Co.), Derby Line, Vt.

PIPE, Steel
Pittsburgh (Pa.) Steel Products Co.

PLANING Machines
American Tool Wks. Co., Cincinnati
Cleveland (O.) Planer Co.
Consolidated Mach. Tool Corp. of Amer., Rochester
Gray Co., G. A., Cincinnati
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Wm., Philadelphia

POLISHING and Buffing Machines
Barnes Co., W. F. & John, Rockford, Ill.
Blanchard Mach. Co., Cambridge.
Blount Co., J. G., Everett, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Heald Machine Co., Worcester.
New Britain-Gridley Mach. Co., New Britain, Conn.
Rowbottom Mach. Co., Waterbury.
Union Twist Drill Co., Athol, Mass.
Van Dorn Electric Tool Co., Cleveland

POLISHING and Buffing Mchs. Elect. Portable
Cincinnati Electrical Tool Co., Cincinnati, Ohio

PRESS Feeds
Littell Mach. Co., F. J., Chicago
V. & O. Press Co., Hudson, N. Y.

PRESSES, Arbor
Barnes Co., W. F. & John, Rockford, Ill.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

PRESSES, Drop Forging
Bliss Co., E. W., Brooklyn, N. Y.
Niagara Machine & Tool Wks., Buffalo
Toledo (O.) Machine & Tool Co.

PRESSES, Foot and Hand
Adriance Mach. Wks., Inc., Brooklyn
Bliss Co., E. W., Brooklyn, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo
Taylor & Fenn Co., Hartford

PRESSES, Forcing
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

PRESSES, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

PRESSES, Power
Adriance Mach. Wks., Brooklyn
Barnes Co., W. F. & John, Rockford, Ill.
Bliss Co., E. W., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Mfg. Co., Hartford
Niagara Mach. & Tool Wks., Buffalo
Rowbottom Mach. Co., Waterbury.
Toledo (O.) Machine & Tool Co.
V&O Press Co., Hudson, N. Y.

PRESSES, Screw
Barnes Co., W. F. & John, Rockford, Ill.
Bliss Co., E. W., Brooklyn, N. Y.

PROFILING Machines
Gorton Mach. Co., Geo., Racine.

PULLEYS, Metal
Johnson Mach. Co., Carlyle, Manchester, Conn.
Jones Fdry. & Mach. Co., W. A., Chicago

PUMPS, Hydraulic & Power
Buffalo (N. Y.) Forge Co.
Elmes Eng. Wks., Chas F., Chicago
Watson-Stillman Co., N. Y.

PUMPS, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence

PUMPS, Portable
National Acme Co., Cleveland, Ohio

PUNCHES, Center
Starrett Co., L. S., Athol, Mass.

PUNCHES, Hand
Armstrong-Blum Mfg. Co., Chicago

PUNCHES, Power
Buffalo (N. Y.) Forge Co.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo

PUNCHING and Shearing Machines
Buffalo (N. Y.) Forge Co.
Consolidated Mach. Tool Corp. of Amer., Rochester
Ryerson & Son, Jos. T., Chicago
Wickes Bros., Saginaw, Mich.

PYROMETERS, Electric
Wilson-Maeulen Co., N. Y. C.

RACKS, Storage
(See Furniture Machine Shop)

REAMERS, Adjustable
Barber-Colman Co., Rockford, Ill.
Davis Boring Tool Co., St. Louis
Gammons-Holman Co., Manchester
Pratt & Whitney Co., Hartford

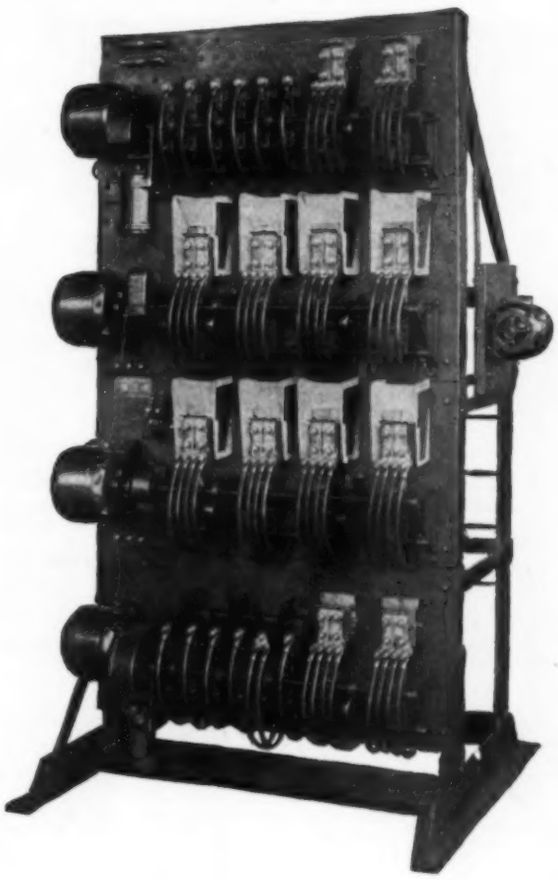
Ohio Torque Motors

For Economy, Quiet Operation and Unfailing Performance in Operating Controls, Cams, Brakes, Valves, Clamps and Similar Devices.

AN interesting application of Ohio Torque Motors for the operation of groups of Electric Switches is shown in the illustration. These switches are closed by the Motor and are opened by a weight, which is carried by the motor shaft. Several of these switches are provided with a dash-pot to control the speed of operation.

Ohio Torque Motors are so wound that they may exert their full power through part of a revolution or through several revolutions and then may be stalled while still exerting full power for various periods, depending upon the winding.

Ohio Torque Motors are available for 10%, 25%, 50% and 100% Locked Service conditions. They are made for A.C. multiphase currents, D.C. currents and to a limited extent for single phase currents. Sizes range from 3 to 64 oz. ft.—that is, from 3 to 64 oz. pressure at a one foot radius. Such Motors can exert an enormous torque when properly geared.



Ohio Engineers will gladly discuss the application of Ohio Torque Motors to your work.

The Ohio Electric Mfg. Co.

5903 Maurice Avenue, Cleveland, Ohio

OHIO reliable MOTORS

OHIO MOTORS

REAMERS, Solid
Barber-Colman Co., Rockford, Ill.
Butterfield & Co. (Divi. of Union Twist Drill Co.), Derby Line, Vt.
Gammons-Holman Co., Manchester.
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford
Union Twist Drill Co., Athol, Mass.

REAMERS, Taper
Barber-Colman Co., Rockford, Ill.
Gammons-Holman Co., Manchester.
Union Twist Drill Co., Athol, Mass.

REAMING Machines
Blanchard Mach. Co., Cambridge.

RHEOSTATS
Cutler-Hammer, Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

RIVET Making Machinery
National Machinery Co., Tiffin, O.

RIVETING Machines
Grant Mfg. & Machine Co., Bridgeport, Conn.
High Speed Hammer Co., Rochester.

RIVET Sets
American Swiss File & Tool Co., Elizabeth

RULES, Steel and Wood
Starrett Co., L. S., Athol, Mass.

RUST Preventatives
Oakite Products, N. Y.

SAWING Machines, Band
Armstrong-Blum Mfg. Co., Chicago

SAWING Machines, Metal
Earle Gear & Machine Co., Phila
Peerless Machine Co., Racine, Wis.
Racine (Wis.) Tool & Mach. Co.

SAWING Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Peerless Machine Co., Racine, Wis.
Racine (Wis.) Tool & Mach. Co.

SAWS, Hack, Frames & Blades
American Saw & Mfg. Co., Springfield, Mass.
Armstrong-Blum Mfg. Co., Chicago
Racine (Wisc.) Tool & Mach. Co.
Starrett Co., L. S., Athol, Mass.

SAWS, Milling
Barber-Colman Co., Rockford, Ill.
National Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SAWS, Screw Slotting
Starrettt Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCALES
Starrett Co., L. S., Athol, Mass.

SCRAPING Machines and Attachments
Anderson Bros. Mfg. Co., Rockford.

SCREW Drivers
Jarvis Co., Chas. L., Gildersleeve, Conn.

SCREW Drivers, Automatic
Errington Mech. Laboratory, S. I N. Y.

SCREW-DRIVERS, Portable Electric & Pneumatic
Cincinnati Electrical Tool Co., Cincinnati, Ohio

SCREW-Machine Work
Eastern Mch. Screw Corp., New Haven
Morris Machine Tool Co., Cinn.
National Acme Co., Cleveland
National Machine Tool Co., Cincinnati
New Britain-Gridley Mach. Co., New Britain, Conn.

SCREW Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Automatic Mach. Co.
Cone Auto. Mch. Co., Windsor, Vt
National Acme Co., Cleveland
New Britain-Gridley Mach. Co., New Britain, Conn.

SCREW Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Automatic Mach. Co.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford
Warner & Swasey Co., Cleveland

SCREW Plates
Butterfield & Co. (Divi. of Union Twist Drill Co.), Derby Line, Vt.
Card Mfg. Co., Mansfield, Mass.

SCREWS, Cap and Set
Allen Mfg. Co., Hartford
Cleveland Cap Screw Co., Cleveland
Danly Machine Specialties, Inc., Chicago
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland

SCREWS, Safety
Strong, Carlisle & Hammond Co., Cleveland

SECOND-HAND Machinery
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Delta Equipment Co., Philadelphia
De Witt Tool Co., N. Y. C.
Eastern Mchy. Co., Cincinnati
Emerman & Co., L. E., Chicago
Essley Mchy. Co., Chicago
General Mchy. Corp., Boston
Hill, Clarke & Co., Chicago
Hyman & Sons, J., Phila.
Lang Machy. Co., Pittsburgh
Miles Machy. Co., Saginaw, Mich.
Morey & Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus
Palmer-Edwards Co., Flint, Mich.
Reed-Prentice Corp., Worcester
Simmons Mach. Tool Corp., Albany
Standard Mchy. & Supply Co., Boston
Strong, Carlisle & Hammond Co., Cleveland

SEPARATORS, Centrifugal
National Acme Co., Cleveland

SEPARATORS, Magnetic
Ohio Elec. Mfg. Co., Cleveland

SEPARATORS, Oil & Waste
Barrett Leon J., Worcester, Mass.
De Laval Separator Co., N. Y. C.

SHAFTING
Bliss & Laughlin, Harvey, Ill.
Ryerson & Son, Jos. T., Chicago
Strand & Co., N. A., Chicago

SHAFTS, Flexible
Haskins Co., R. G., Chicago
Strand & Co., N. A., Chicago

SHAPERS
American Tool Wks. Co., Cincinnati
Cincinnati (O.) Shaper Co.
Hanson-Whitney Machine Co., Hartford
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford
Ryerson & Son, Jos. T., Chicago
Smith & Mills Co., Cincinnati
Springfield (O.) Machine Tool Co.

SHEARS, Power
Adriance Mach Wks., Brooklyn
Buffalo (N. Y.) Forge Co.
Consolidated Mach. Tool Corp. of Amer., Rochester
Ferracute Machine Co., Bridgeton,
Niagara Mch. & Tool Wks., Buffalo
Toledo (O.) Machine & Tool Co.

SHEET Metal Working Machinery
Adriance Mach Wks., Brooklyn
Bliss Co., E. W., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mch. & Tool Wks., Buffalo
Ryerson & Son, Jos. T., Chicago
Toledo (O.) Machine & Tool Co.

SLOTTING Machines
Consolidated Mach. Tool Corp. of Amer., Rochester
Sellers & Co., Wm., Philadelphia

SPECIAL Machinery
(See Contract Work)

SPEED Box, Motor Drive
Rivett Lathe & Grinder Corp., Brighton, Boston

SPEED Reducers
Adams Co., Dubuque, Ia.
Boston Gear Works, Sales Co Quincy, Mass.
Cleveland (O.) Worm & Gear Co
Earle Gear & Machine Co., Philadelphia
Grant Gear Works, Boston
Hartford (Conn.) Special Machinery Co.
Jones Fdry. & Mach. Co., W Chicago
Perkins Mach. & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Wks.

SPINDLES
Ex-Cell-O Aircraft Tool Corp., Detroit

SPRING Winders
Hjorth Lathe & Tool Co., Boston

SPROCKETS and Chains
Bilgram Mach. Wks., Philadelphia
Boston Gear Works, Sales Co Quincy, Mass.
Cullman Wheel Co., Chicago
Grant Gear Wks., Boston
Jones Fdry. & Mach. Co., W. A., Chicago
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Works

SQUARES
Starrett Co., L. S., Athol, Mass.

STAMPING Attachment, Press
Marquette Tool & Mfg. Co., Chicago

STAMPINGS, Metal
Detroit (Mich.) Stamping Co.
Standard Pressed Steel Co., Jenkintown, Pa.

STAMPS, Steel
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Noble & Westbrook Mfg. Co., Hartford

STEELS, Alloy, Carbon and High Speed
Bliss & Laughlin, Harvey, Ill.
Hawkridge Bros. Co., Boston
Illinois Steel Co., Chicago
Latrobe (Pa.) Electric Steel Co.
Ryerson & Son, Jos. T., Chicago
Timken Roller Bearing Co. Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STOOLS, Shop
(See Furniture, Machine Shop)

STRAIGHTENING Machinery
Springfield (O.) Mch. Tool Co.

STUD Setters
Errington Mech. Laboratory, S. I. N. Y.

SUBPRESSES and Dies
Danly Mach. Spec., Inc., Chicago
U. S. Tool Co., Ampere, N. J.
Waltham (Mass.) Mach. Wks.

SWAGING Machines
Etna Machine Co., Toledo, O.
Langelier Mfg. Co., Providence
Torrington Co., Torrington, Conn.

TAP Extensions
Allen Mfg. Co., Hartford

TAP Extractors, Broken
Walton Co., Hartford

TAP Holders
Errington Mech. Laboratory, S. I. N. Y.
Jarvis Co., Chas. L., Gildersleeve, Conn.

TAPES, Measuring
Starrett Co., L. S., Athol, Mass.

TAPPING Machines and Attachments
Acme Machinery Co., Cleveland
American Tool Wks. Co., Cincinnati
Baker Bros., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Bradford Machine Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Errington Mech. Laboratory, S. I. N. Y.
Fox Machine Co., Jackson, Mich.
Geometric Tool Co., New Haven,
Globe Tapping Mach. Co., Bridgeport
Jarvis Co., Chas. L., Gildersleeve, Conn.
Kingsbury Machine Tool Corp., Keene, N. H.
Moline (Ill.) Tool Co.
Murchey Mach. & Tool Co., Detroit
National Machinery Co., Tiffin, O.

TAPS and Dies
Butterfield & Co. (Divi. of Union Twist Drill Co.), Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield.
Hanson-Whitney Machine Co., Hartford
Landis Machine Co., Waynesboro.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford

TAPS, Collapsing
Geometric Tool Co., New Haven,
Landis Machine Co., Waynesboro.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland

TAPS, Ground
Hanson-Whitney Mach. Co., Hartford
Jones & Lamson Mach. Co., Springfield, Vt.

TEMPERATURE Controllers, Automatic
Wilson-Maeulen Co., N. Y. C.

TESTING Apparatus, Hardness
Shore Instrument & Mfg. Co., Jamaica, N. Y.
Wilson-Maeulen Co., N. Y. C.

THREAD-Cutting Machines
Brown & Sharpe Mfg. Co., Providence
Eastern Mch. Screw Corp., New Haven, Conn.
Ferner Co., R. Y., Washington
Geometric Tool Co., New Haven.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Landis Machine Co., Waynesboro.
Murchey Mach. & Tool Co., Detroit
National Machinery Co., Tiffin, O.

THREAD-CUTTING Tools
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Geometric Tool Co., New Haven,
Hanson-Whitney Machine Co., Hartford
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland

THREAD Rolling Machines
National Machinery Co., Tiffin, O.

TOOL Bits
Vanadium-Alloys Steel Co., Latrobe, Pa.

TOOL Holders
Armstrong Bros. Tool Co., Chicago
O. K. Tool Co., Shelton, Conn.

TOOL Posts, Lathe
Armstrong Bros. Tool Co., Chicago
O. K. Tool Co., Shelton, Conn.

TOOLS, Cutting-off
Armstrong Bros. Tool Co., Chicago

TOOLS, Diamond
Desmond-Stephan Mfg. Co., Urbana.

TOOLS, Small
(See Machinist Small Tools)

TRANSFORMERS
Jones Fdry. & Mach. Co., W. A., Chicago
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

TUBING, Copper & Brass
Wolverine Tube Co., Detroit

TUBING, Seamless
Pittsburgh (Pa.) Steel Products Co.
Timken Roller Bearing Co., Canton, O.

TURBINES, Steam
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

TURRET Machines
(See Lathes, Horizontal Turret)

TURRETS, Tool Post
American Tool Wks. Co., Cincinnati

UNIONS, Pipe
Dart Mfg. Co., E. M., Providence

VALVES
Elmes Eng. Wks., Chas. F., Chicago

VISE Stands
New Britain-Gridley Mach. Co., New Britain, Conn.

VISES, Drilling Machine
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Brown Eng. Co., Reading, Pa.
Hartford (Conn.) Special Machy. Co.
United States Automatic Box Machinery Co., Newtonville, Boston

VISES, Milling Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co
Hartford (Conn.) Special Machy. Co.
United States Automatic Box Machinery Co., Newtonville, Boston

VISES, Pipe
Butterfield & Co. (Divi. of Union Twist Drill Co.), Derby Line, Vt.

VISES, Planer and Shaper
United States Automatic Box Machinery Co., Newtonville, Boston

VISES, Universal Machine
Hoggson & Pettis Mfg. Co., New Haven, Conn.
United States Automatic Box Machinery Co., Newtonville, Boston

WASHERS Plain
Detroit (Mich.) Stamping Co.

WASHING & Drying Machines, Metal Parts
Barrett Leon J., Worcester, Mass.
Colts Patent Fire Arms Mfg. Co., Hartford

WELDING Machines, Butt
Swift Electric Welder Co., Detroit

WELDING Machines, Electric
Federal Mach. & Welder Co., Warren, O.
Taylor-Winfield Corp., Warren, Ohio
Thomson-Gibb Electric Welding Co., Bay City, Mich.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

WELDING Mach. Spot
Swift Electric Welder Co., Detroit

WELDING Supplies
Taylor-Winfield Corp., Warren, Ohio

WIRE, Insulated
Simplex Wire & Cable Co., Boston

WOOD Working Machy
Barnes Co., W. F. & John, Rockford
Seneca Falls (N. Y.) Machine Co.

WORM Drives
Cleveland (O.) Worm & Gear Co.
Hartford (Conn.) Special Mach. Co.
Perkins Machine & Gear Co., Springfield, Mass.

WRENCHES, Drop Forged
Armstrong Bros. Tool Co., Chicago

WRENCHES, Ratchet
Card Mfg. Co., S. W., Mansfield, O.
Starrett Co., L. S., Athol, Mass.

WRENCHES, Tap
Butterfield & Co. (Divi. of Union Twist Drill Co.), Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Starrett Co., L. S., Athol, Mass.

X-RAY Apparatus
Eastman Kodak Co., Rochester

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